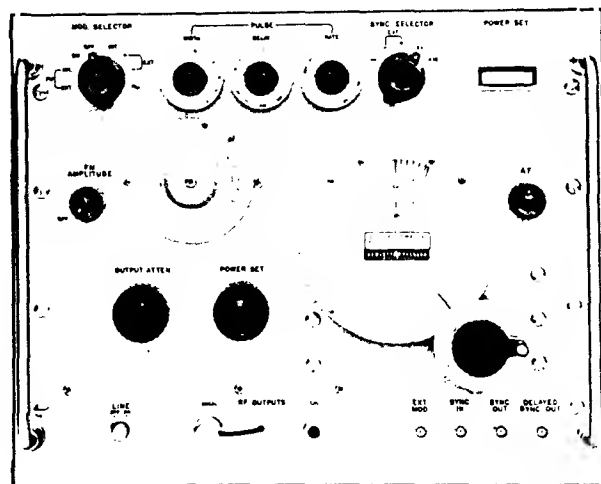


OPERATING AND SERVICE MANUAL

618C 620B SHF SIGNAL GENERATOR



**HEWLETT
PACKARD**

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OPERATING AND SERVICE MANUAL

618C, 620B SHF SIGNAL GENERATOR

SERIALS PREFIXED

618C: 1621A

620B: 1621A

This Operating and Service Manual applies directly to instruments bearing above serial prefixes.

SERIAL PREFIXES NOT LISTED

For instruments with higher serial number prefixes than above, refer to the enclosed MANUAL CHANGES supplement. For instruments with serial number prefixes lower than above, refer to Appendix II at rear of manual.



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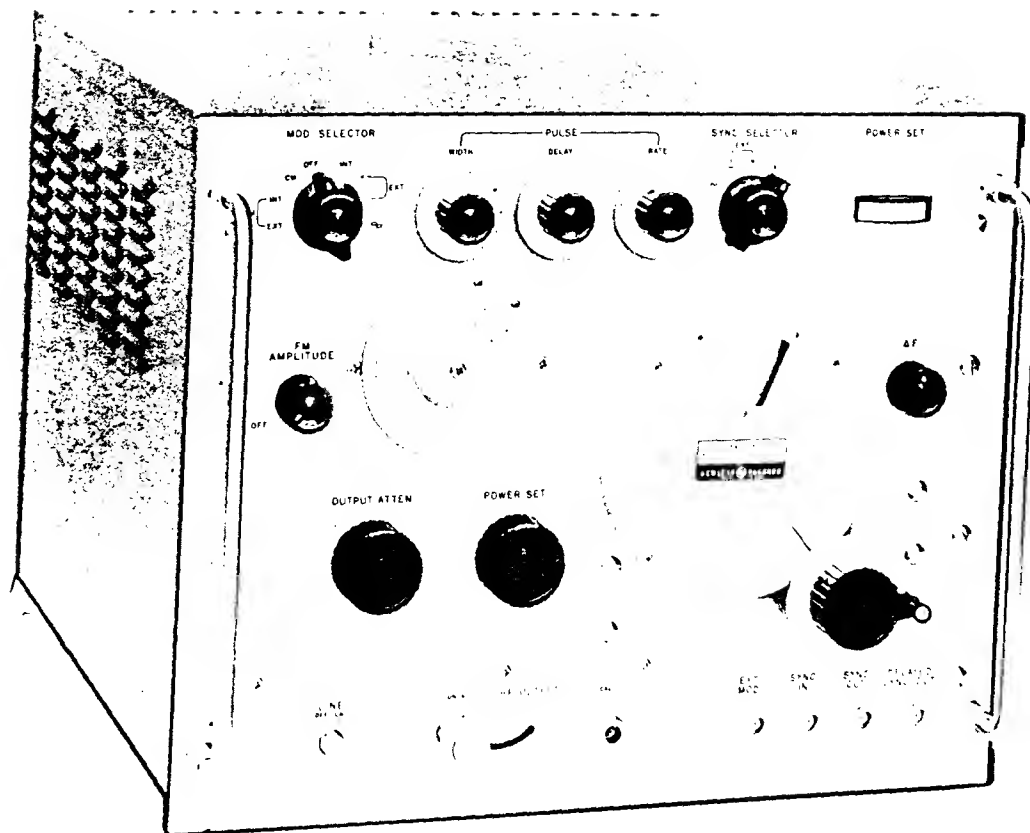


Figure 1-1. Model 618C/620B SHF Signal Generators

SECTION I

GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The Hewlett-Packard Models 618C/620B SHF Signal Generators (Figure 1-1) provide RF signal output in the frequency ranges of 3800 to 7600 MHz, and 7000 to 11,000 MHz respectively. At least 1-mW power output is available over the entire frequency range. The output frequency is indicated on a direct-reading dial. The RF output power is adjustable by an attenuator that is calibrated in μ V and dB.

1-3. Five types of modulation are available: internal pulse modulation, external pulse modulation, internal frequency modulation, external frequency modulation, and internal square-wave modulation.

1-4. The internal pulse modulation has a variable repetition rate of 40 to 4,000 Hz. Pulse width is variable from 0.5 to 10 μ s as measured at the pulse 50% amplitude points. Internal square wave modulation is variable from 40 to 4,000 Hz.

1-5. The Signal Generator can be modulated by external pulses of positive or negative polarity. The amplitude of the modulating pulses may be 20 to 70V, and the pulse width between 0.5 and 2500 μ s.

1-6. Internal frequency modulation comprises a sawtooth sweep rate of 40 to 4,000 Hz. Frequency deviation is variable from 0 to 5 MHz over most of the band. External frequency modulation from an external sine wave is provided. Frequency deviation is approximately 5 MHz.

1-7. Synchronization outputs of the Signal Generator comprise two types: delayed, and undelayed. The delayed synchronization output is a positive pulse that

occurs simultaneous with the RF pulse. The pulse has an amplitude of 25 V minimum and a rise time less than 1 μ s when terminated in a load of 1000 ohms or more. The undelayed synchronization pulse has the same characteristics as the delayed pulse, except the pulse occurs between 3 to 300 μ s (as adjusted by front-panel control) before the RF pulse.

1-8. Both the pulse- and frequency-modulated RF output may be synchronized with the following externally generated signals: sine waves of 40 to 4,000 Hz, and 5 to 50V amplitude; pulses of 40 to 4,000 Hz, a peak amplitude of 5 to 50V, a rise time of 0.1 to 1 μ s, and a width of 0.5 to 5 μ s.

1-9. INSTRUMENT IDENTIFICATION.

1-10. Hewlett-Packard instruments have a two-part serial number. The first four digits are the serial prefix. If the prefix on your instrument is not listed on the title page of this manual, in the appendix, or on a Manual Change sheet enclosed with the manual, the correct information may be obtained from any Sales and Service Office listed at the rear of this manual.

Table 1-1. Specifications

Output**Frequency Range:**

618C: 3,800 to 7,600 MHz covered in a single band.

620B: 7 to 11 GHz covered in a single band.

Repeller voltage automatically tracked and proper mode automatically selected

Calibration: Direct reading. Frequency calibration accuracy better than $\pm 1\%$.

Vernier: ΔF control has a minimum range of 0.5 MHz (618C), 1.5 MHz (620B) over most of the band for fine tuning. Remote ΔF connector on rear panel permits fine tuning with external potentiometer; tuning range at least 0.5 MHz (618C), 1.5 MHz (620B) over most of the band with potentiometer ≥ 2 megohms.

Frequency Stability:

With Temperature: Less than $0.006\%/^{\circ}\text{C}$ change in ambient temperature.

With Line Voltage: Less than 0.02% change for line voltage variation of $\pm 10\%$.

Residual FM: < 15 kHz peak.

Output Range: 1 milliwatt or 0.224 volt to 0.1 microvolt (0 dBm to -127 dBm) into 50 ohms. Directly calibrated in microvolts and dB. Coaxial Type N connector.

Output Accuracy: Within ± 2 dB from -7 to -127 dBm, within ± 3 dB from 0 to -7 dBm, at front panel connector, terminated in 50-ohm load. Temperature-compensated detector circuit monitors RF oscillator power level. An auxiliary, fixed-level RF output (at least 0.3 mW) is provided on the front panel for use with other equipment such as a frequency counter or phase-lock instrumentation.

Source Impedance: 50 ohms nominal; reflection coefficient less than 0.33 (2 SWR, 9.6 dB return loss.)

Modulation

Modulation: Internal or external pulse, FM, and square wave.

Internal Pulse Modulation: Repetition rate variable from 40 to 4,000 pps, pulse width variable $1/2$ to 10 microseconds.

Sync Out Signals: Simultaneous with RF pulse, positive. In advance of RF pulse, positive, variable 3 to 300 microseconds. (Better than 1 microsecond rise time and 25 to 100 volts amplitude into 1,000-ohm load.)

External Synchronization:

Sine Wave: 40 to 4,000 Hz, 5 to 50 V rms.

Pulse: 40 to 4,000 pps, 5 to 50 V peak, positive or negative, 0.5 to $5\mu\text{sec}$ wide, 0.1 to $1\mu\text{sec}$ rise time.

Internal Square Wave Modulation: Variable, 40 to 4,000 Hz, controlled by PULSE RATE control.

Internal Frequency Modulation: Sawtooth sweep rate adjustable 40 to 4,000 Hz. Frequency deviation to 5 MHz peak-to-peak over most of the frequency range.

External Pulse Modulation: Pulse requirements: amplitude from 20 to 70 volts peak positive or negative, width 0.5 to 2,500 microseconds.

External FM: Frequency deviation approximately 5 MHz peak-to-peak over most of the band. Sensitivity approximately 20 V/MHz at front-panel connector, approximately 10 V/MHz at rear panel connector (mating connector supplied.) Front-panel connector is capacitively coupled to klystron repeller; rear-panel connector is dc coupled to klystron repeller and is suitable for phase-lock control input.

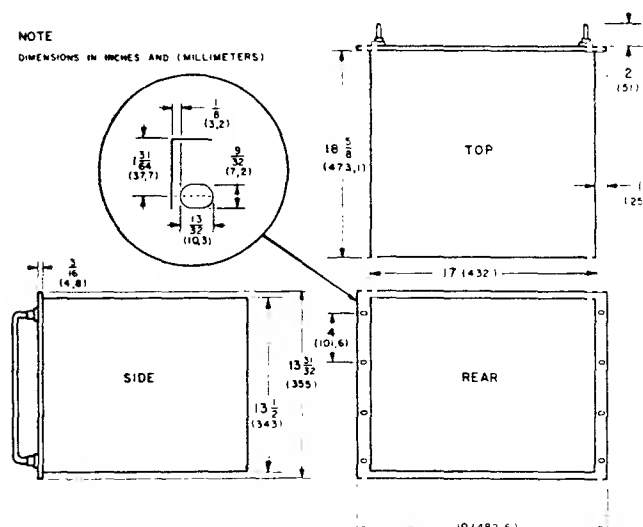
General

Power Source: 115 or 230 volts $\pm 10\%$, 50 to 60 Hz, 230 W.

RFI: Conducted and radiated leakage limits are below those specified in MIL-I-6181D.

Dimensions: Cabinet Mount: 17-1/2 in. wide, 13-7/8 in. high, 20-3/8 in. deep behind panel (445 x 353 x 517 mm).

Rack Mount:



Weight: Net, 69 lbs. (31,1 kg). Shipping, 90 lbs. (40,5 kg).

Accessory Furnished: 11500A Cable Assembly, 6 feet (1830 mm) of specially treated RG-214A/U 50-ohm coaxial cable terminated at each end with UG-21D/U Type N male connectors; 7-1/2-ft. (2290 mm) power cable.

Accessories Available: 11001A Cable Assembly, 45 in. long, RG-58C/U 50-ohm Coax, terminated by dual banana connector on one end, BNC on other. 10503A Cable Assembly, 4 feet long, RG-58C/U 50-ohm Coax, terminated on each end by BNC male connectors.

SECTION II

INSTALLATION

2-1. INCOMING INSPECTION.

2-2. The Signal Generator was carefully inspected, both mechanically and electrically, prior to shipment. Inspect it for mechanical damage received in transit, check for supplied accessories, and test electrical performance using the procedure given in Section V. If there is damage or deficiency, or if electrical performance is not within specifications, see the warranty inside the front cover of this manual.

2-3. PREPARATION FOR USE.

2-4. POWER REQUIREMENTS.

2-5. The Signal Generator requires a power source of 115 or 230 V ac $\pm 10\%$, single phase. The power source must supply approximately 250 W.

2-6. 115/230 VOLT OPERATION.

2-7. A two-position slide switch, on the rear panel, permits operation from either a 115 or 230 V power source. The number visible on the switch slider indicates the line voltage for which the Signal Generator is connected.

2-8. To prepare the Signal Generator for operation, set the 115-230 V switch so that the number visible on the slider corresponds to the available line voltage. Install a fuse of correct rating.

CAUTION

To avoid damage to the Signal Generator, before connecting the power cable, set the 115-230 V switch for the line voltage to be used.

2-9. POWER CABLE.

2-10. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that the Signal Generator panel and cabinet be grounded. Accordingly, the Signal Generator is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the panel and cabinet. The offset pin of the three-prong connector is the ground pin.

2-11. To preserve the protection feature when operating the Signal Generator from a two-contact outlet, use a three-prong to two-prong adapter (HP Part No. 1251-0048) and connect the green pigtail on the adapter to ground.

2-12. COOLING.

2-13. Forced air cooling is used to maintain safe operating temperatures within the Signal Generator cabinet. The air intake and exhaust ports, cooling fan, and air filter are located at the rear of the cabinet. To ensure adequate ventilation, maintain about three inches of clearance behind the cabinet.

CAUTION

Do not operate the Signal Generator if the fan is not operational.

2-14. AIR FILTER.

2-15. The air filter, as received with a new Signal Generator, has a coating of dust-catching substance which improves air cleaning action. To maintain adequate ventilation, clean and recoat the air filter at regular intervals. See Section V for cleaning instructions.

2-16. REPACKING FOR SHIPMENT.

2-17. If the Signal Generator is to be packaged for shipment use the original shipping container and packing materials. If these have been discarded or not in condition for reuse, obtain new materials from your local Hewlett-Packard Sales and Service Office (see rear of this manual for locations), or follow these general instructions:

a. Wrap the Signal Generator in heavy paper or plastic. (If the Signal Generator is being shipped to a Hewlett-Packard service facility, attach a tag indicating type of servicing required, return address, model number, and full serial number.)

b. Use a strong shipping container. A carton made of 500- to 600-pound test material will usually provide adequate protection.

c. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard. With Hewlett-Packard "floater pack" packaging, the foam blocks provide sufficient shock protection, and additional material is unnecessary.

d. Seal the shipping container securely.

e. Mark the shipping container "FRAGILE" to assure careful handling.

2-18. In any correspondence refer to the Signal Generator by model number and full serial number.

SECTION III OPERATION

3-1. INTRODUCTION.

3-2. This section provides instruction to properly operate the Signal Generator. Included are general operating information; a description of controls, connectors, and indicators; and basic operating procedures for each mode of operation.

3-3. GENERAL OPERATING INFORMATION.

CAUTION

Do not connect RF or dc power in any magnitude to the output terminals of this instrument. As little as 0.2 W can permanently damage the attenuator probe. Extreme care should be exercised when working with transceiver-type equipment to insure that the transmitter section is not operating while the Model 618C 620B is connected to the transceiver antenna.

3-4. **OUTPUT ACCURACY.** The accuracy of the output system and the calibration of the attenuator in the Model 618C 620B is determined at the front-panel output jack. Output cable losses must be considered in addition to the attenuator dial indication when employing specific signal levels at the end of the output cable.

3-5. Erratic instrument performance at the output terminals, or no power output is frequently an indication that the instrument has been subjected to abuse. This condition may be confirmed by measuring either the dc resistance of the attenuator or the SWR looking into the panel connector. Dc resistance is approximately 50 ohms. SWR (at panel connector) is 2.0 or less.

3-6. The klystron used in this instrument is expensive and has a shorter life (approximately 1000 hours) than that of a conventional vacuum tube. Power should be removed from the Signal Generator when it is not in use in order to increase the useful life of the klystron.

3-7. CONTROLS, CONNECTORS AND INDICATORS.

3-8. Front-panel controls, connectors, and indicators are shown and described in Figure 3-1.

3-9. BASIC OPERATING PROCEDURES.

3-10. TURN ON.

a. Set rear-panel 115-230V switch to match line voltage, and check that the line fuse has correct rating.

b. Connect Signal Generator to power source.

c. Depress LINE switch. Allow 5-minute warm-up time. If ambient temperature is below 10°C (50°F), allow a longer warmup period.

3-11. DETAILED OPERATING PROCEDURES.

CAUTION

Do not use the Signal Generator if the cooling fan does not operate at turn-on.

3-12. Detailed operating procedures are given in Figure 3-2 through 3-7.

3-13. OPERATION WITH THE DYMEC DY-2650A OSCILLATOR SYNCHRONIZER.

The 618C/620B is easily adapted for use with the DY-2650A Synchronizer as follows:

1. Remove the internal shorting jumper from J303, pins A & B. Refer to Figure 5-22. The jumper is connected between the klystron reflector and its power supply across R526.
2. Connect the mating connector J7 to P2 on the DY-2650A. This is to protect a user from accidentally contacting the otherwise exposed pins of P2, one of which will be at the reflector potential after completion of step 3.
3. Connect the klystron reflector lead and the reflector voltage lead to pins G and F, respectively, of J5 on the DY-2650A. An RG-59A/U type cable is recommended for this connection.

No other modifications are normally required. The RF sample for the DY-2650A must be obtained from the signal generator output connector through a suitable coupler. Varying the output level from the signal generator to the device being tested will also vary the RF sample level into the DY-2650A. It is therefore necessary to set the RF output level from the signal generator to a fixed value and to use an external attenuator for varying the level to the device under test if wide ranges in level are required.

CAUTION

When the shorting jumper has been removed from the klystron reflector supply voltage as described in step 1 above, the 620B must not be operated without being connected to the DY-2650A unless the reflector lead jumper is replaced. Omission of the jumper will damage the klystron.

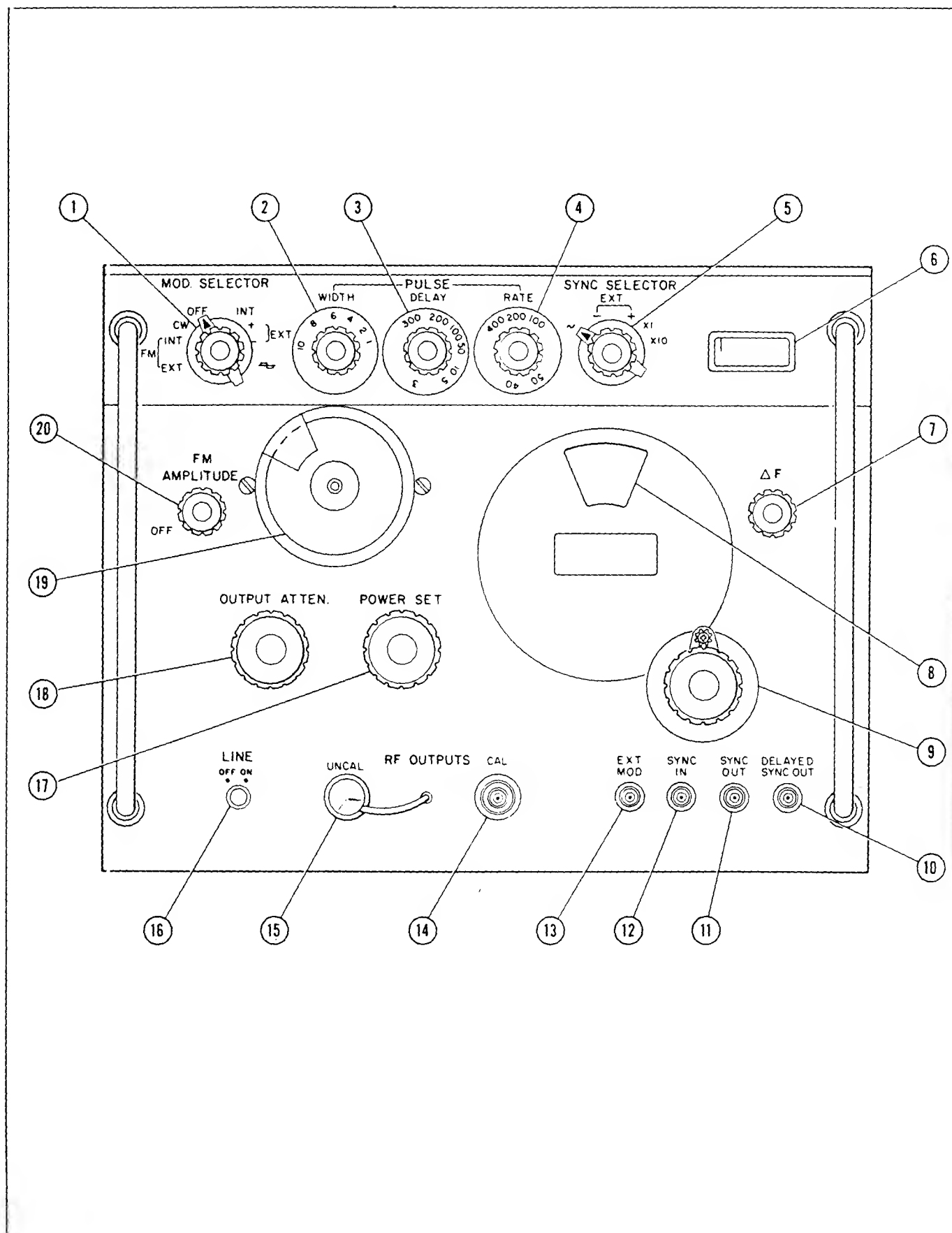


Figure 3-1. Front-panel Controls, Connectors, and Indicators (Part 1 of 2)



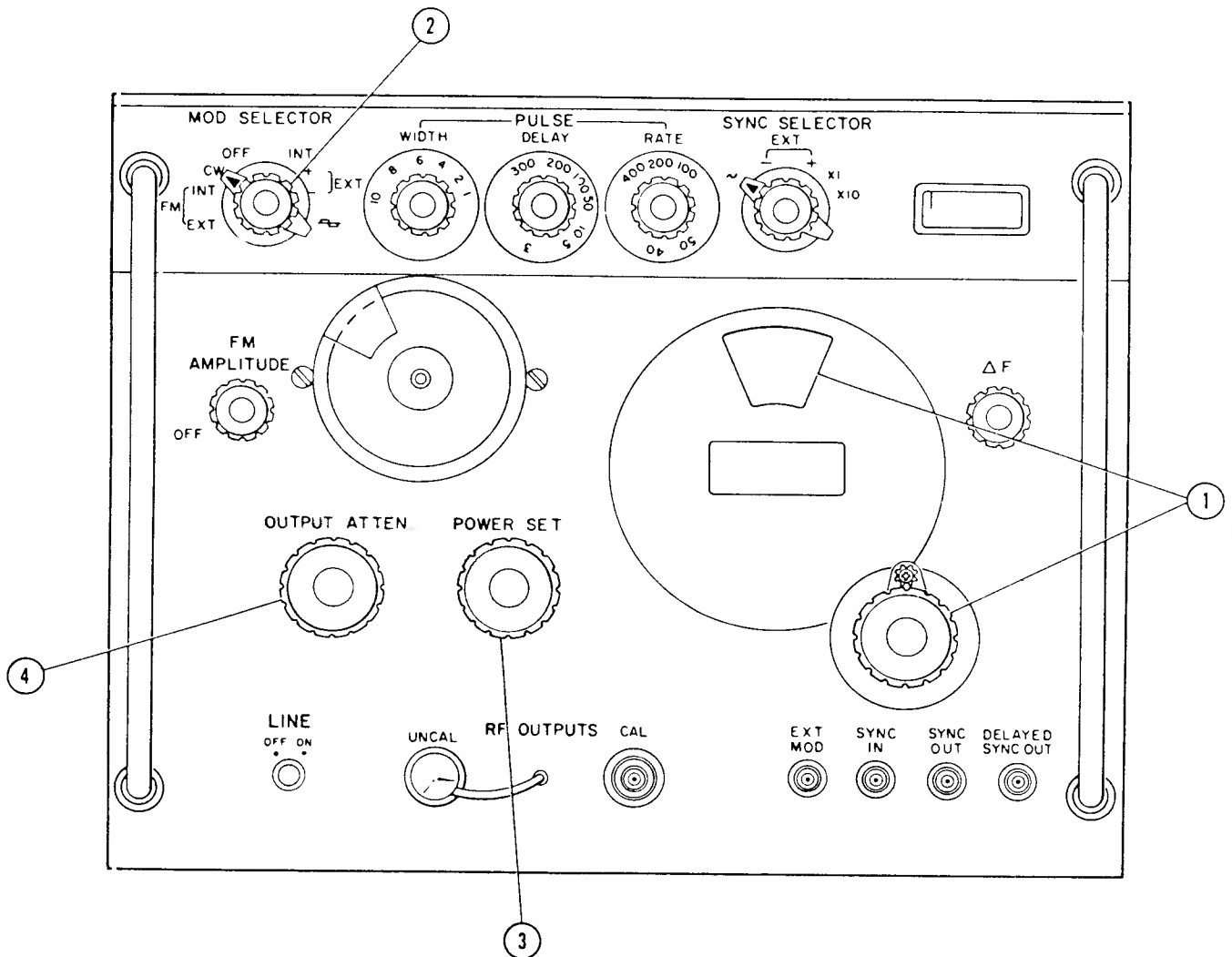
1. **MOD. SELECTOR.** In FM EXT position, sine wave or sawtooth applied to EXT. MOD connector modulates Signal Generator. In FM INT position, an internally generated sawtooth modulates the Signal Generator. In CW position, the Signal Generator is not modulated. In OFF position, Signal Generator RF output is disabled. In INT. position, the Signal Generator is modulated by internally generated pulses. In EXT+ position, the Signal Generator can be modulated by positive pulses applied to the EXT. MOD. connector. In EXT- position, the Signal Generator can be modulated by negative pulses applied to the EXT. MOD. connector. In  position Signal Generator is modulated by internally generated square waves (approximately 50% duty cycle).
2. **PULSE WIDTH.** Adjusts width of modulating pulse when MOD. SELECTOR is set to INT.
3. **PULSE DELAY.** Adjusts the delay time between synchronizing pulse and RF output pulse from 3 to 300 μ s.
4. **PULSE RATE.** Adjusts pulse repetition rate of modulation when MOD SELECTOR is set to INT. FM INT, or  position and SYNC SELECTOR is in X1 or X10 position. When SYNC SELECTOR is in X1 position, pulse rate is indicated by PULSE RATE control; when SYNC SELECTOR is in X10 position, pulse rate is 10 times that indicated by PULSE RATE control.
5. **SYNC SELECTOR.** In ~ position, and when MOD. SELECTOR is set to INT, Signal Generator may be synchronized by external sine-wave signal of 5-50 V rms applied to SYNC. IN connector. In EXT- position, and when MOD. SELECTOR is in INT position, Signal Generator must be synchronized by negative pulses (5-50 V peak-to-peak) applied to SYNC. IN connector. In EXT+ position, and when MOD. SELECTOR is set to INT, the Signal Generator must be synchronized by external positive pulses (5-50 V peak-to-peak) applied to the SYNC. IN connector. In X1 position, and MOD. SELECTOR is set to INT, the modulation repetition rate is as indicated by the PULSE RATE control. In the X10 position, and when MOD. SELECTOR is set for INT, the modulation repetition rate is 10 times that indicated by the PULSE RATE control.
6. **Power Meter.** Indicates RF power input in dBm to attenuator.
7. **Δ F.** Provides up to 0.5 MHz adjustment of output frequency for 618C; 1.5 MHz for 620B.
8. **MHz/GHz.** Indicates RF output frequency in megahertz/gigahertz for 618C/620B respectively.
9. **Frequency Control.** Adjusts RF output frequency.
10. **DELAYED SYNC. OUT.** Delayed (3-300 μ s) synchronization signal is available at this connector.
11. **SYNC. OUT.** Undelayed synchronization output signal is available at this connector.
12. **SYNC. IN.** External synchronization signal is applied to this connector.
13. **EXT. MOD.** External modulation signal is applied to this connector.
14. **RF OUTPUTS CAL.** Source of calibrated RF power is available at this connector.
15. **RF OUTPUTS UNCAL.** Uncalibrated RF output power is available at this connector.
16. **LINE.** Turns Signal Generator on and off.
17. **POWER SET.** Adjusts RF power input to attenuator.
18. **OUTPUT ATTEN.** Adjusts RF output power to a calibrated level.
19. **Attenuator Dial.** Indicates RF output level when power meter is indicating 0.
20. **FM AMPLITUDE.** Adjusts frequency deviation of RF when using frequency modulation.

Figure 3-1. Front-Panel Controls, Connectors, and Indicators (Part 2 of 2)



Note

Perform turn-on procedure described in paragraph 3-10.

1. Adjust frequency control for desired RF output frequency as indicated on dial. ΔF is vernier turning which can be adjusted by the knob on the front panel or by varying a potentiometer connected to the ΔF connector on the rear (see specifications).

2. Set MOD. SELECTOR to CW.

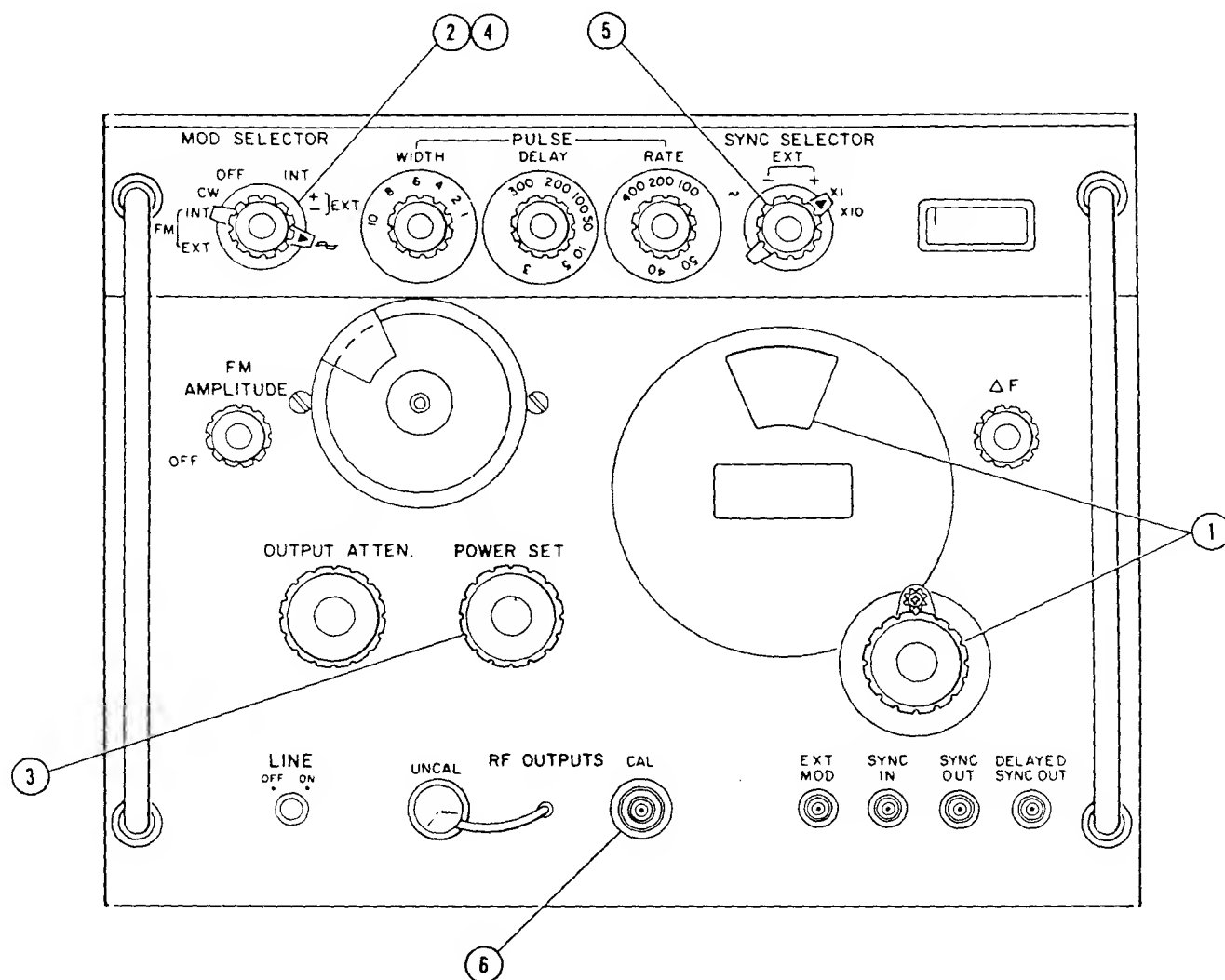
3. Adjust POWER SET for 0 indication on power meter.

4. Adjust OUTPUT ATTEN. for desired output level as indicated by attenuator dial.

Note

ΔF control should be centered when not in use.

Figure 3-2. CW Operation



Note

Perform turn-on procedure described in paragraph 3-10.

1. Adjust frequency control for desired RF output frequency as indicated on dial.
2. Set MOD. SELECTOR to CW.
3. Adjust POWER SET for 0 indication on power meter.
4. Set MOD. SELECTOR TO \square .

5. Set SYNC SELECTOR TO X1 or X10 and adjust PULSE RATE control for desired square-wave frequency.
6. Connect RF cable between RF OUTPUTS CAL. connector and equipment being tested.

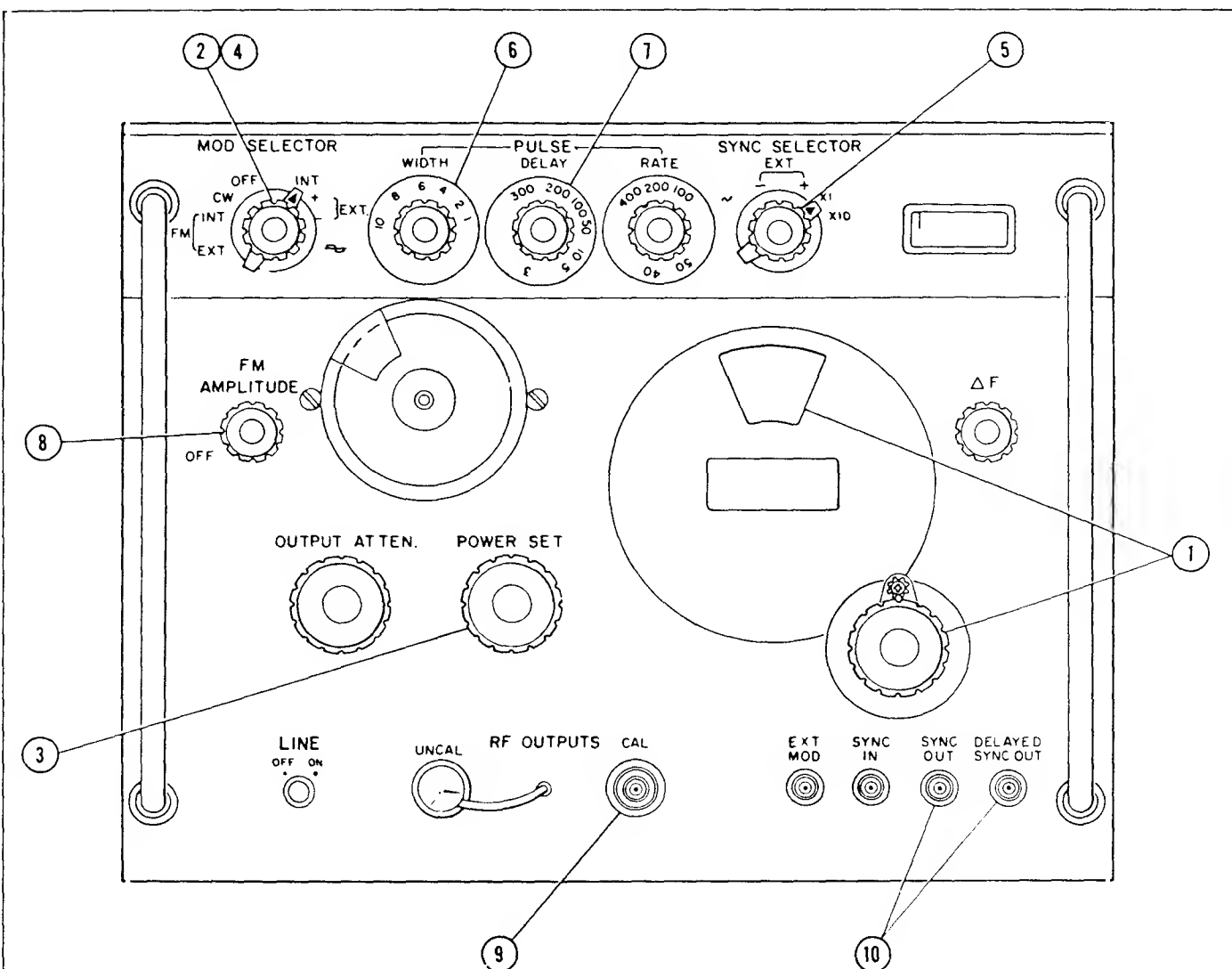
Note

Synchronization pulses occurring at the modulation rate are available at the SYNC. OUT connector.

Note

ΔF control should be centered when not in use.

Figure 3-3. Internal Square-Wave Modulation Operation



Note

Perform turn-on procedure described in paragraph 3-10.

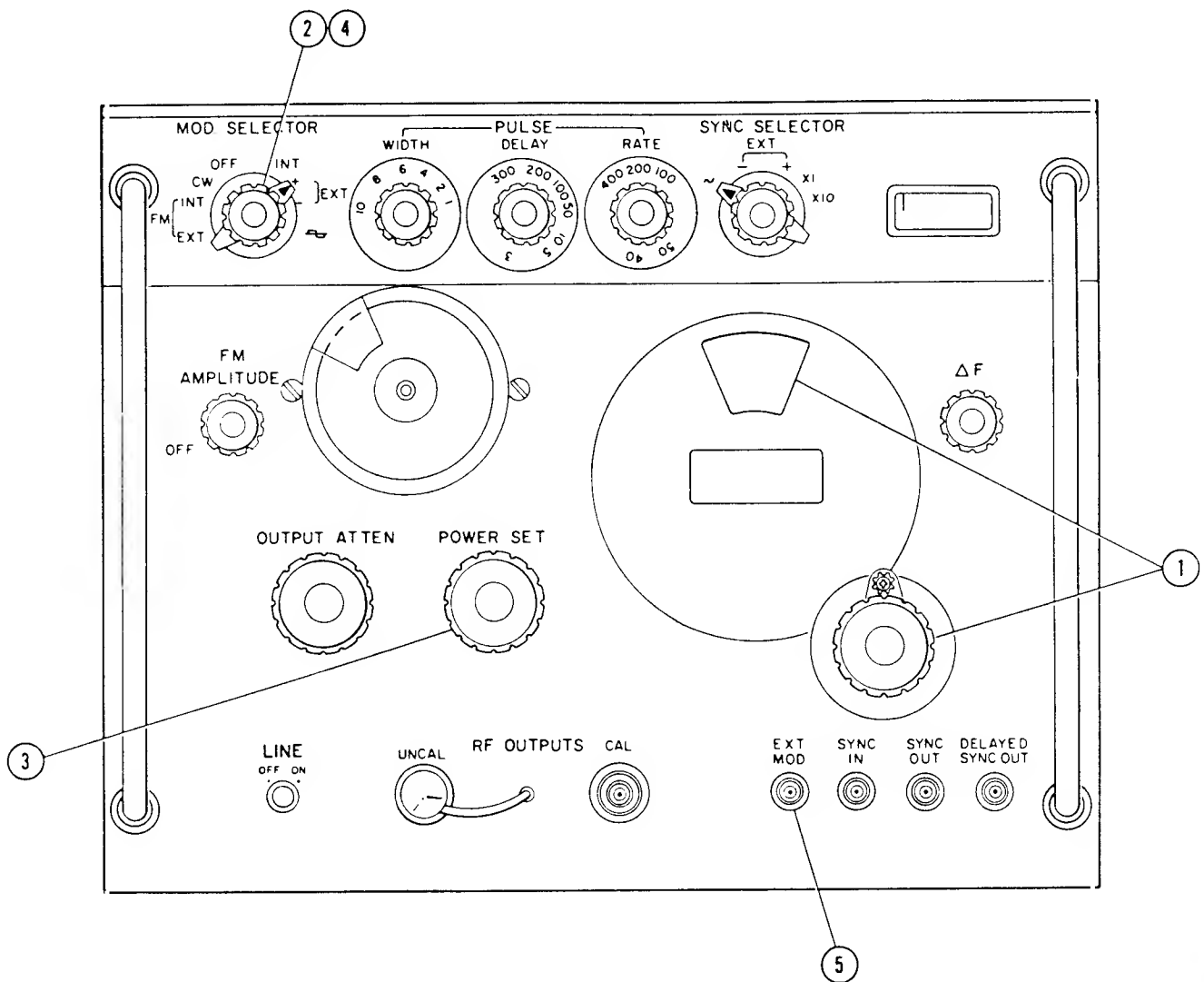
1. Adjust frequency control for desired RF output frequency as indicated on dial.
2. Set MOD. SELECTOR to CW.
3. Adjust POWER SET for 0 indication on power meter.
4. Set MOD. SELECTOR to INT.
5. Set SYNC SELECTOR to X1 or X10, and adjust PULSE RATE control for desired pulse repetition rate.

6. Adjust PULSE WIDTH control for desired modulation pulse width.
7. Adjust PULSE DELAY control for desired delay time.
8. Set FM AMPLITUDE control to OFF.
9. Connect RF cable between RF OUTPUTS CAL connector and equipment being tested.
10. Connect pulse cable between the SYNC OUT and or DELAYED SYNC OUT connectors and external equipment as required by the application.

Note

ΔF control should be centered to obtain optimum pulse rise and decay.

Figure 3-4. Internal Pulse Modulation Operation



Note

Perform turn-on procedure described in paragraph 3-10.

1. Adjust frequency control for desired RF output frequency as indicated on dial.
2. Set MOD. SELECTOR to CW.
3. Adjust POWER SET for 0 indication on power meter.
4. Set MOD. SELECTOR to EXT or EXT-, as required by the polarity of the external modulating pulses.

5. Connect external modulating source to EXT. MOD. connector. External modulating pulses must have peak-to-peak amplitude of between 20 and 70V.

Note

In this mode of operation, no synchronization pulses are available at the DELAYED SYNC. OUT or SYNC. OUT connector.

Note

ΔF control should be centered to obtain optimum pulse rise and decay.

Figure 3-5. External Pulse Modulation Operation

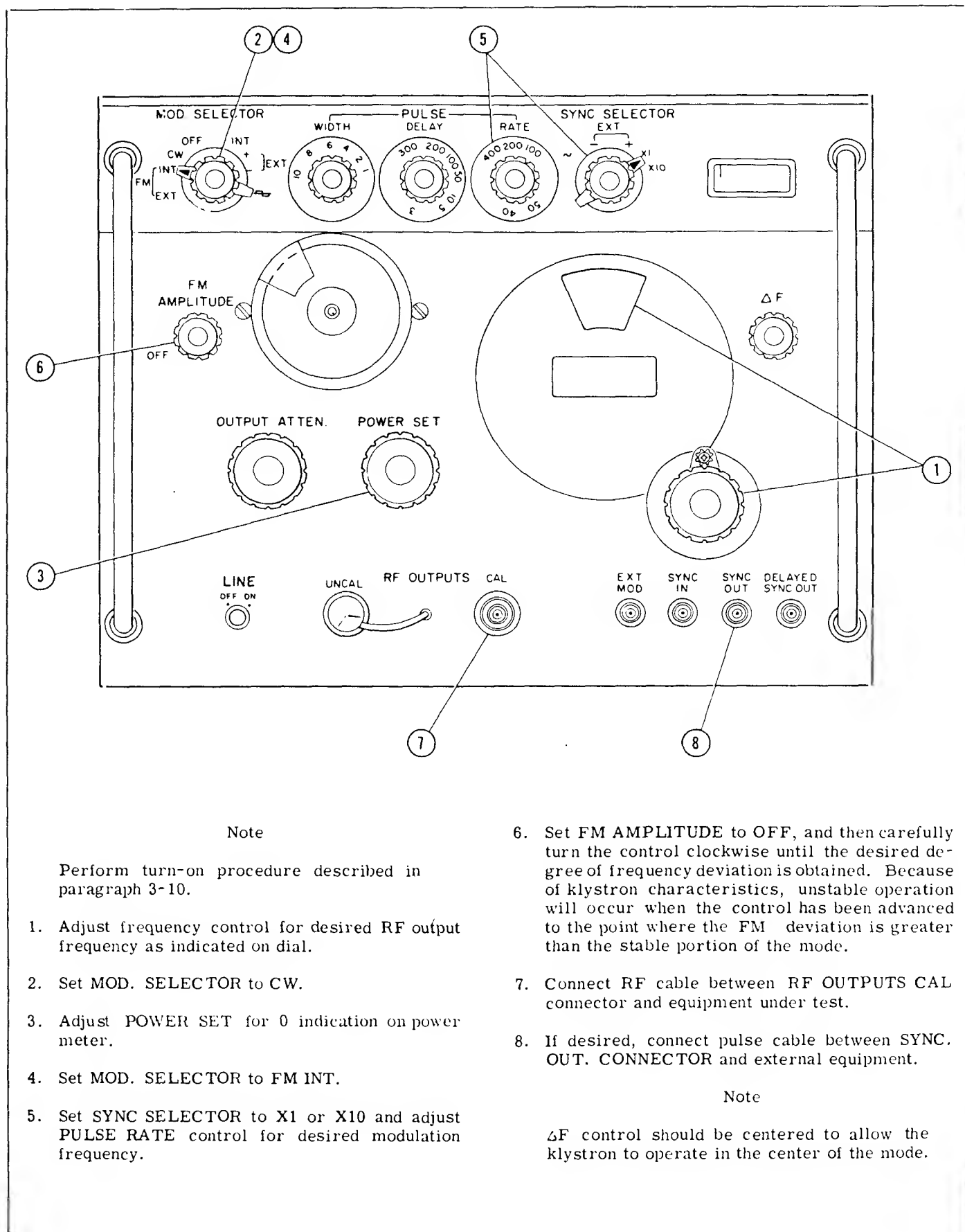
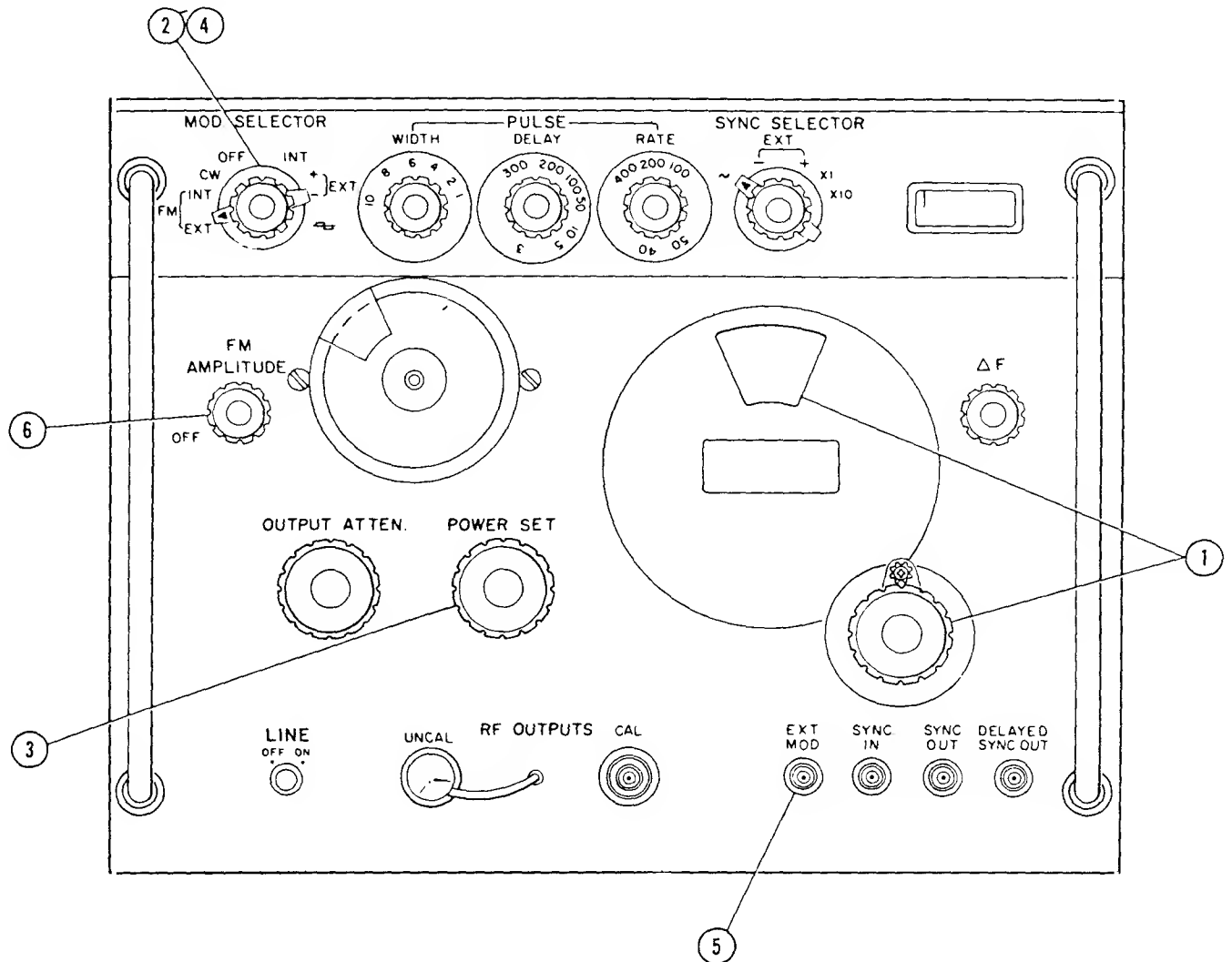


Figure 3-6. Internal Frequency Modulation Operation



Note

Perform turn-on procedure described in paragraph 3-10.

1. Adjust frequency control for desired RF output frequency as indicated on dial.
2. Set MOD. SELECTOR to CW.
3. Adjust POWER SET for 0 indication on power meter.
4. Set MOD SELECTOR to FM EXT.
5. Connect external modulation voltage to the EXT. MOD. connector. The modulation signal should have a level of at least 70 V rms.

6. Set FM AMPLITUDE to OFF, and then carefully turn the control clockwise until the desired degree of frequency deviation is obtained. Because of klystron characteristics, unstable operation will occur when the control has been advanced to the point where the FM deviation is greater than the stable portion of the mode.

Note

In this mode of operation, no synchronization pulses are available at the DELAYED SYNC. OUT or SYNC. OUT connector.

Note

ΔF control should be centered to allow the klystron to operate in the center of the mode.

Figure 3-7. External Frequency Modulation Operation

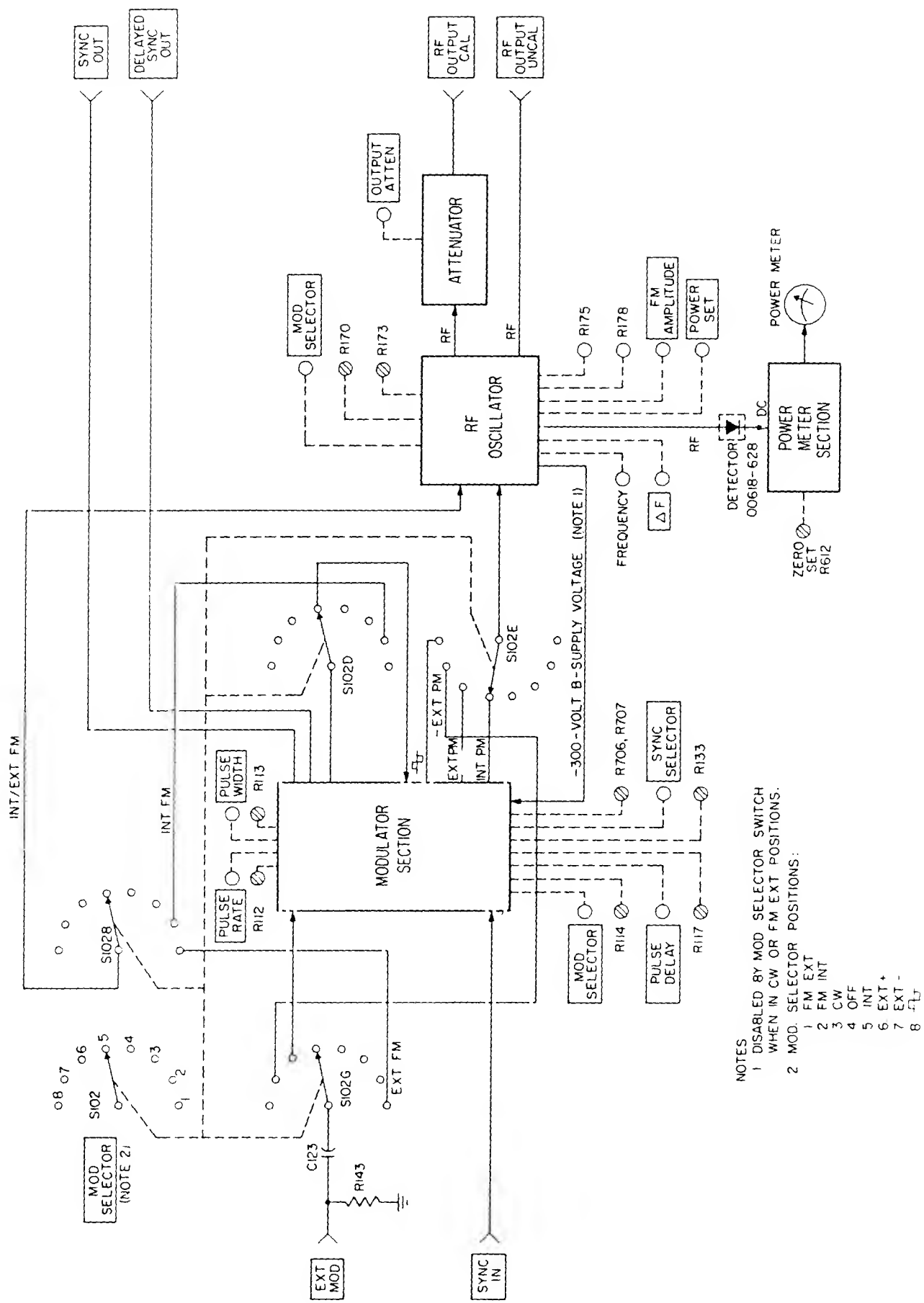


Figure 4-1. Simplified Block Diagram

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains explanations of the operation of the Signal Generator circuits. Figure 4-1 is a simplified block diagram showing principal circuit sections and operating controls. Each circuit section and important individual circuits are explained in succeeding paragraphs.

4-3. THE MODULATOR SECTION.

4-4. The Modulator Section is shown in block diagram form in Figure 4-2. The function of the circuits in this section is to establish a modulating pulse (for pulse operation) or a sawtooth voltage (for frequency modulation) and to apply it to the RF oscillator to obtain the desired type of RF output. Various portions of these circuits are not employed in certain types of operation, such as external pulse or external FM operation (see Figure 4-1). However, the block diagram shows the condition (delayed pulse output with external synchronization) where all of the circuits are employed, and the description will cover this type of operation. Other types of operation will be described in later paragraphs.

4-5. SYNCHRONIZING CIRCUITS. These circuits accept the external synchronizing voltage applied at the SYNC IN connector, and transform it into a negative pulse to trigger Pulse Rate Multivibrator V103. The circuit elements are shown in Figure 4-3. The grid of V101A is returned to B+ (ground). This places the grid at zero bias and the tube is conducting through plate load resistor R103. The tube responds to both positive and negative signals.

4-6. The negative-going portion of a sine-wave synchronizing voltage, or a negative synchronization pulse, causes the tube to cut off, developing a positive pulse in its plate circuit. This pulse is applied to the grid of V101B. Tube V101B is cut off (bias of -15 V) and the positive pulse from the plate of V101A causes V101B to conduct; thus, its plate voltage drops and the output is a negative-going pulse with a steep leading edge.

4-7. This negative pulse is applied to the ~ and (-) contacts of SYNC SELECTOR switch S101A through Series Clipper V102A. Clipper V102A develops only negative pulses at its output.

4-8. When a positive external synchronization pulse is applied to the grid of V101A, a negative pulse is developed in its plate circuit and applied through capacitor C103 to the + contact of S101A.

4-9. PULSE RATE MULTIVIBRATOR, SYNC CONDITION. When external sine-wave synchronization signals are employed, the Synchronization Multivibrator is switched to the operating condition shown in Figure 4-4. This circuit is a one-shot multivibrator,

with V103A drawing current while V103B is cut off. The negative pulse from the synchronization input circuits causes the multivibrator to switch at t_1 , developing a negative pulse in the plate circuit of V103B. The width of the pulse is determined by the length of time required to discharge capacitor C111 through resistor R115.

4-10. PULSE RATE MULTIVIBRATOR, FREE-RUNNING CONDITION. In the FM INT, INT (pulse), and \square positions of MOD. SELECTOR switch S102, the Pulse Rate Multivibrator is converted to a free-running multivibrator (Figure 4-5). Under this condition the synchronization input circuits are disconnected from the multivibrator.

4-11. The time constants of the multivibrator are balanced so that the circuit generates a wave that is essentially square with approximately a 50% duty cycle; however, this may vary depending upon the repetition rate. This arrangement is used so that internal square-wave as well as internal pulse modulation of the RF Oscillator can be obtained. The arrangement also provides for equally spaced pulses to trigger the Sawtooth Generator when internal FM modulation is being used.

4-12. PULSE SHAPER. The Pulse Shaper (Figure 4-6) is a One-Shot Multivibrator with a 2- μ s pulse duration. It consists of V104A and V104B, two halves of type 5814A dual triode. In the steady-state condition, V104A is conducting as its grid is returned to the cathode by resistor R121. Tube V104B is cut off as its grid is returned to -300V, thus placing a bias on the grid (developed by the current through V104A and cathode resistor R120).

4-13. When this multivibrator is triggered by the negative-going leading edge of the waveform generated by the Pulse Multivibrator, a positive 2- μ s pulse appears at the plate of V104A.

4-14. The positive output pulse is applied to the Synchronization Amplifier tube, V105A, shown in Figure 4-7, and to Synchronization Cathode Follower V105B, shown in Figure 4-6.

4-15. SYNCHRONIZATION CATHODE FOLLOWER. This stage provides the undelayed synchronization output signal for synchronizing external equipment. It is comprised of V105B, one half of a type 5814 dual-triode tube. The output is taken across R129, the cathode resistor, and is capacitively coupled through C118 to the SYNC. OUT connector. Resistor R130 is returned from the center conductor of the connector to ground, so that the line is terminated in reference to ground instead of the -300V potential existing at the base of the cathode resistor.

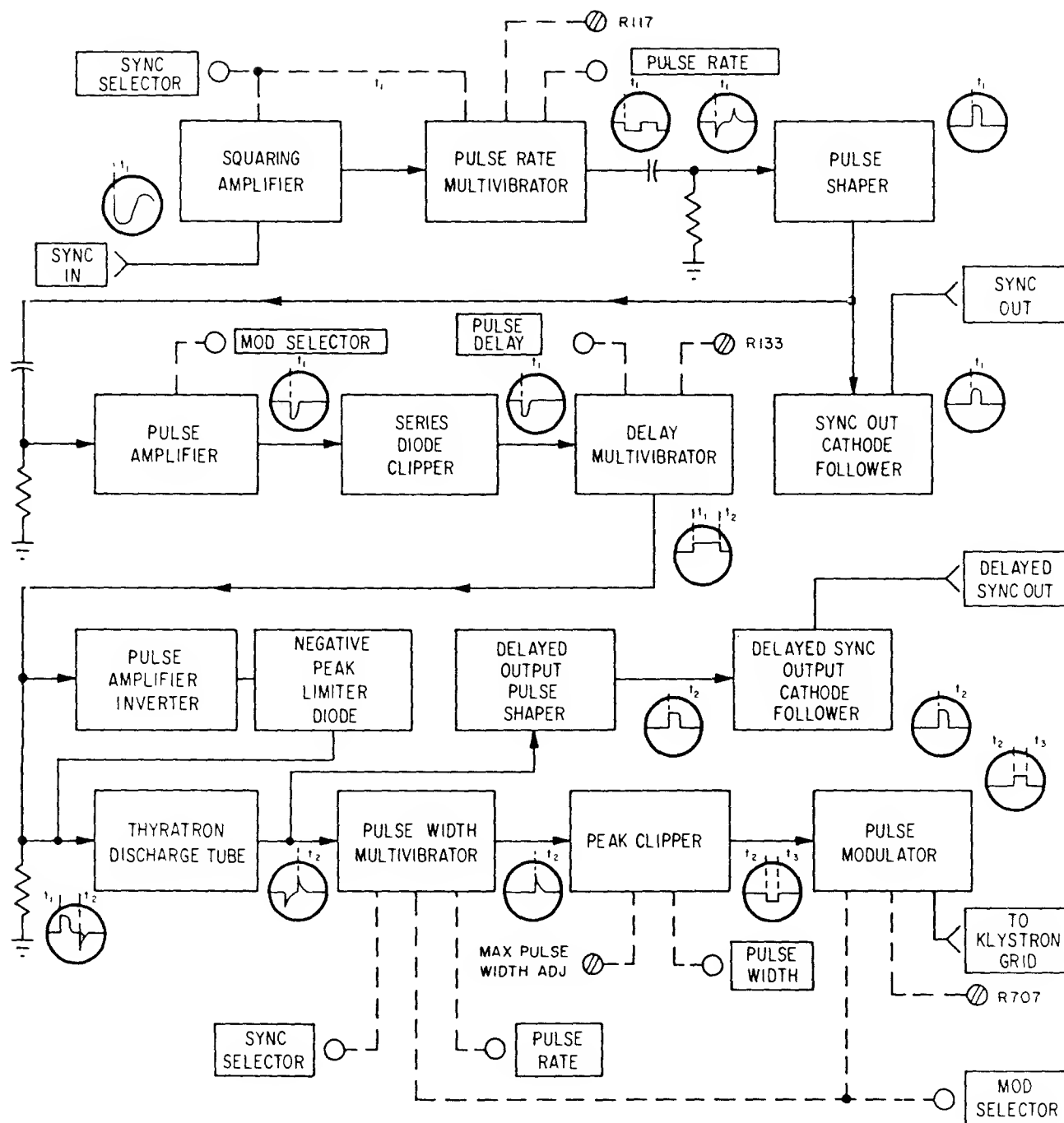


Figure 4-2. Modulator Section Block Diagram

4-16. The output of the Cathode Follower is a positive pulse greater than 25 V peak-to-peak when applied to a load having a resistance of from 1000 to 100,000 ohms and a shunt capacitance of 500 pF.

4-17. **PULSE AMPLIFIER.** The Pulse Amplifier is comprised of V105A, one-half of a type 12AU7 tube (Figure 4-7), and its associated components. It amplifies and inverts the 2 μ s pulse provided by the Pulse Shaper and provides a positive pulse (in its cathode circuit) that is employed to trigger the Sawtooth Generator when internal frequency modulation is employed.

Capacitor C115 acts as a cathode bypass capacitor when internal pulse modulation is used.

4-18. **SERIES LIMITER.** The negative pulse from the plate of the Pulse Amplifier is applied to the cathode of diode limiter V106A (Figure 4-7). This limiter is so connected that only the negative components with an amplitude greater than the diode bias are applied to the cathode of the Delay Multivibrator. This prevents triggering the multivibrator by any positive or low-amplitude negative transients that may appear on the output of V105A in addition to the desired trigger pulse.

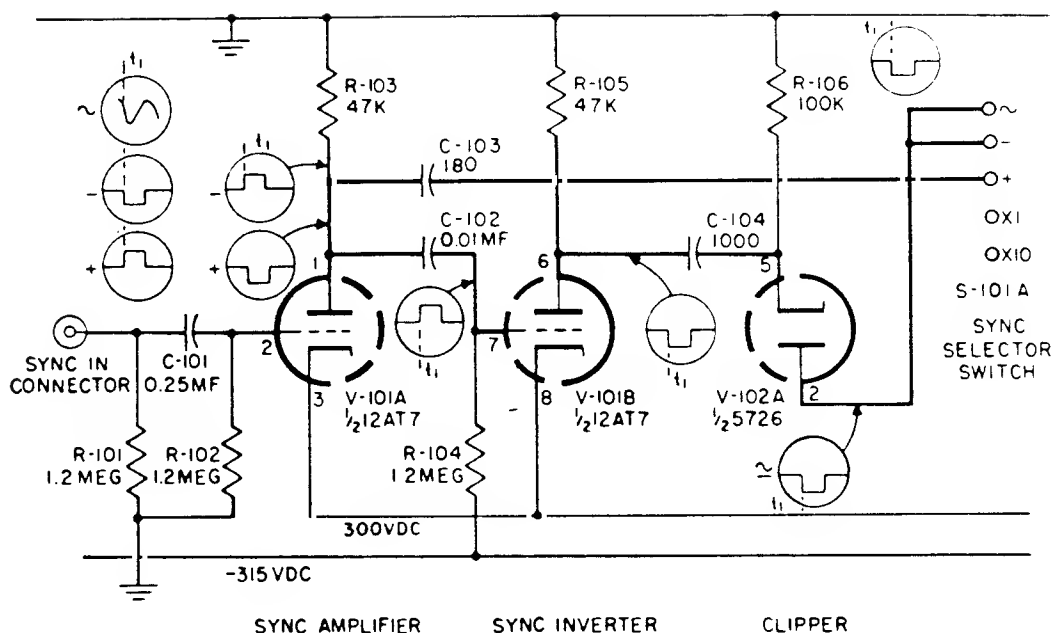


Figure 4-3. Schematic Diagram of Synchronizing Circuits

4-19. **DELAY MULTIVIBRATOR.** This circuit (Figure 4-7) provides an adjustable time delay in applying the modulation to the RF Oscillator. It consists of a type 12AU7 dual triode, V107, connected as a one-shot multivibrator with an adjustable resistor R136, the PULSE DELAY control.

4-20. The Delay Multivibrator starts its cycle when a negative pulse drives the cathode of V107A in a negative direction. This is equivalent to placing a positive signal on the grid, and the tube conducts. A negative wave-front appears at the plate of V107A and

(through capacitor C120) drives the grid of V107B in a negative direction, cutting off this half of the stage. The length of time the circuit requires to return to its resting condition is determined by the time constant of C120, R136 and R137. Potentiometer R136 is the PULSE DELAY control that adjusts the delay from 3 to 300 μ s while Potentiometer R133 is an adjustment used to set the maximum delay to 300 μ s.

4-21. In the steady-state condition V107A is cut off while V107B is conducting through plate load resistors R138, R139 and R140, in parallel with resistor R142 and diode V106B.

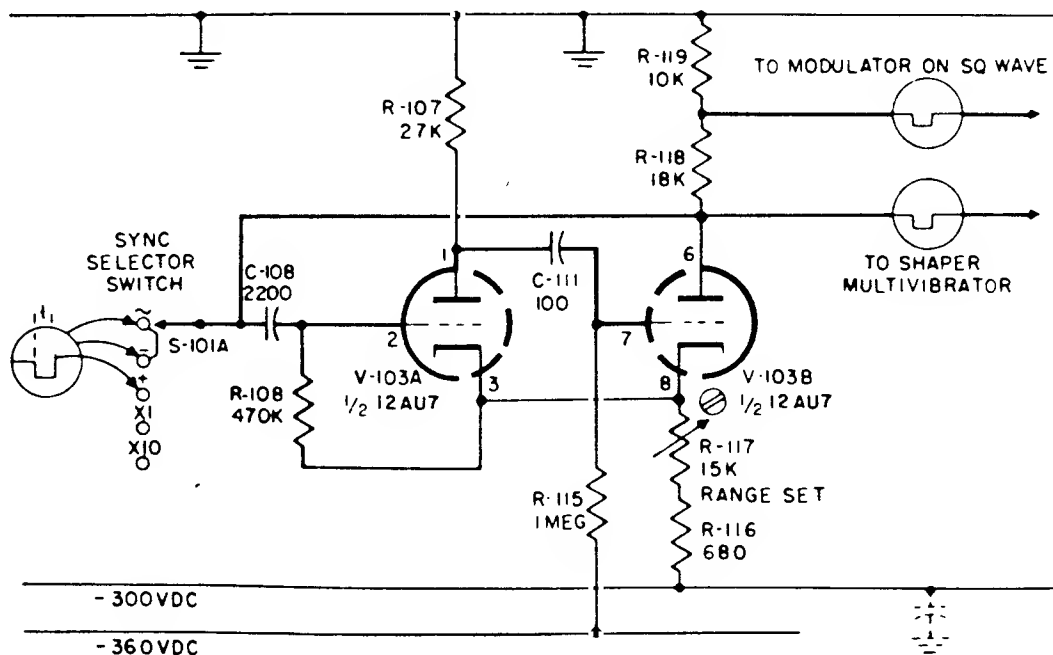


Figure 4-4. Schematic of Pulse-Rate Multivibrator, Synchronized Condition

is connected to the positive supply point (ground) through resistor R162. As a result, the other side of capacitor C130 is at a relatively higher potential due to the drop across resistor R158.

4-33. When the positive pulse at t_2 is applied to the grid of V111A, V111A immediately conducts, causing the V111A side of capacitor C130 to rise to the potential established by the current through resistor R156; thus, resistor R156 acts as a maximum delay-time adjustment for the circuit.

4-34. The voltage rise across resistor R156 is applied to the cathode of V111B, causing it to become more positive with respect to its control grid. This cuts off the tube rapidly, since the grid is maintained at the cathode potential by the time constant of R162 and C132.

4-35. Capacitor C130 is now charged and commences to discharge. The time required to discharge to a point where V111B again conducts determines the duration of the negative output pulse. The width is adjusted by R158, the PULSE WIDTH control. This control can be adjusted to provide pulses between 0.5 and 10 μ s. The output of the Pulse Length Multivibrator is a negative pulse, starting at t_2 and ending at t_3 . Diodes CR101, CR102 serve to limit the negative pulse to approximately 10 V peak-to-peak. The limited pulse is applied to Klystron Modulator tube V701.

4-36. KLYSTRON MODULATOR (618C). The Klystron Modulator (Figure 4-11) is comprised of tube V701 and associated parts. The modulation pulse is applied through capacitor C701 to the grid of V701. The output of the Klystron Modulator is developed

across plate resistors R703 and R705. Diode CR703 serves as a clipper to limit the amplitude of the pulse applied to the Klystron. When the pulse at the plate of V701 is more positive than the voltage present at the cathode of CR703, the diode conducts and limits the pulse. The voltage at which CR703 conducts is established by the setting of potentiometer R706, part of a voltage divider (R702, R706, R708) connected between the -300 and -1000 volt lines. When the Signal Generator frequency control is at a predetermined setting, switch S103 is actuated and places potentiometer R707 in parallel with a portion of potentiometer R706. This results in diode CR703 clipping at a more negative voltage point on the modulation pulse. During any operating mode but amplitude modulation (pulse or square wave), the SYNC SELECTOR switch (S102) opens the cathode of V701, and thus disables the Klystron Modulator.

4-37. KLYSTRON MODULATOR (620B). The Klystron Modulator (Figure 4-12) is comprised of tube V701 and associated parts. The modulation pulse is applied through capacitor C701 to the grid of V701. The output of the Klystron Modulator is developed across plate resistors R703 and R705. Diode CR703 serves as a clipper to limit the amplitude of the pulse applied to the Klystron. When the pulse at the plate of V701 is more positive than the voltage present at the cathode of CR703, the diode conducts and limits the pulse. The voltage at which CR703 conducts is established by the setting of potentiometer R706, part of a voltage divider (R702, R706, R708) connected between the -300 and -1000 volt lines. During any operating mode but amplitude modulation (pulse or square wave),

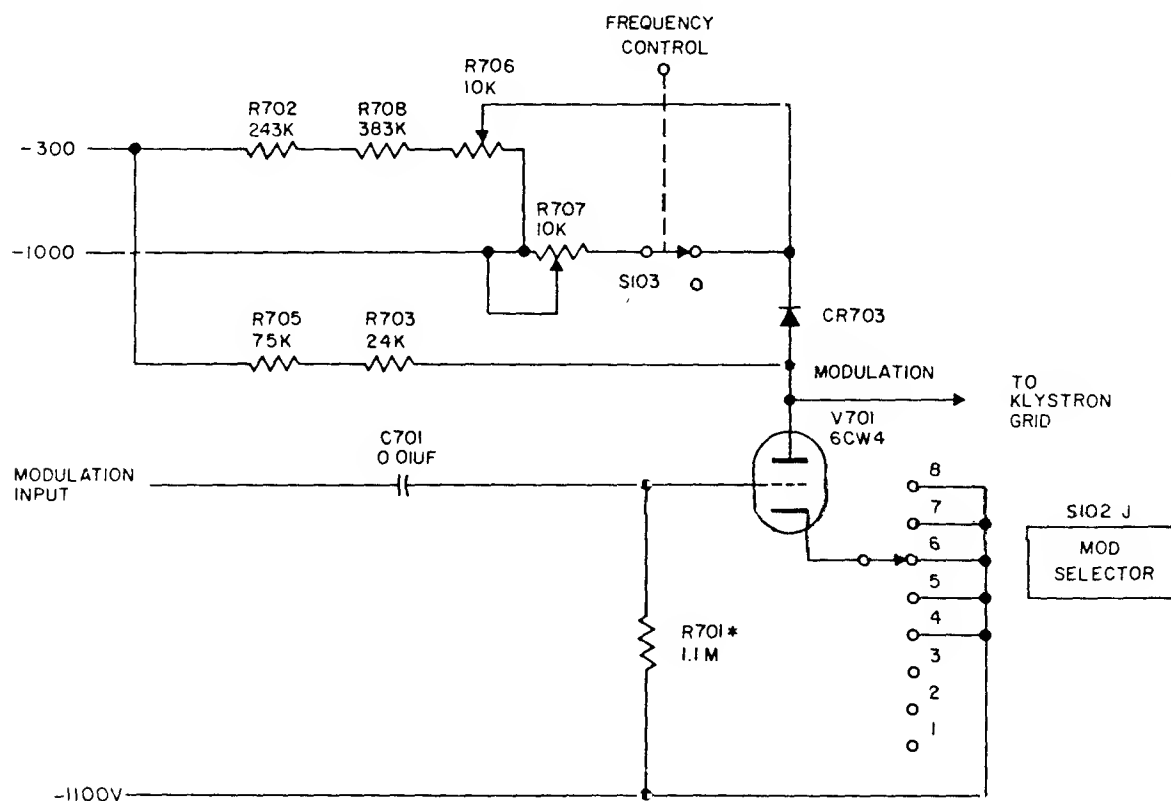


Figure 4-11. Schematic of Klystron Modulator (618C)

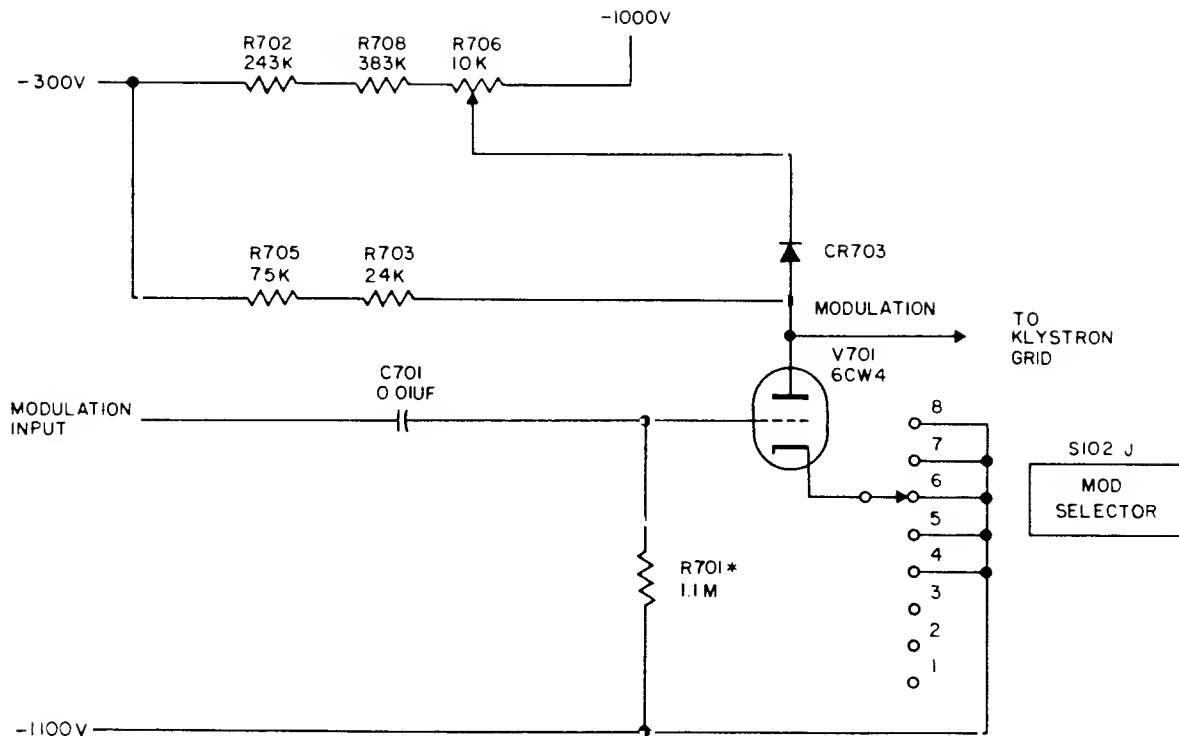


Figure 4-12. Schematic of Klystron Modulator (620B)

the SYNC SELECTOR switch (S102) opens the cathode of V701, and thus disables the Klystron Modulator.

4-38. INTERNAL FM MODULATOR. When MOD. SELECTOR switch S102 is in the FM INT position, the Thyatron Discharge tube comprises a relaxation os-

cillator (Figure 4-13). This oscillator develops a sawtooth waveform that is applied to the RF Oscillator repeller.

4-39. Capacitors C124, C125, C126, and resistors R146, R147 determine the time constant of the sawtooth

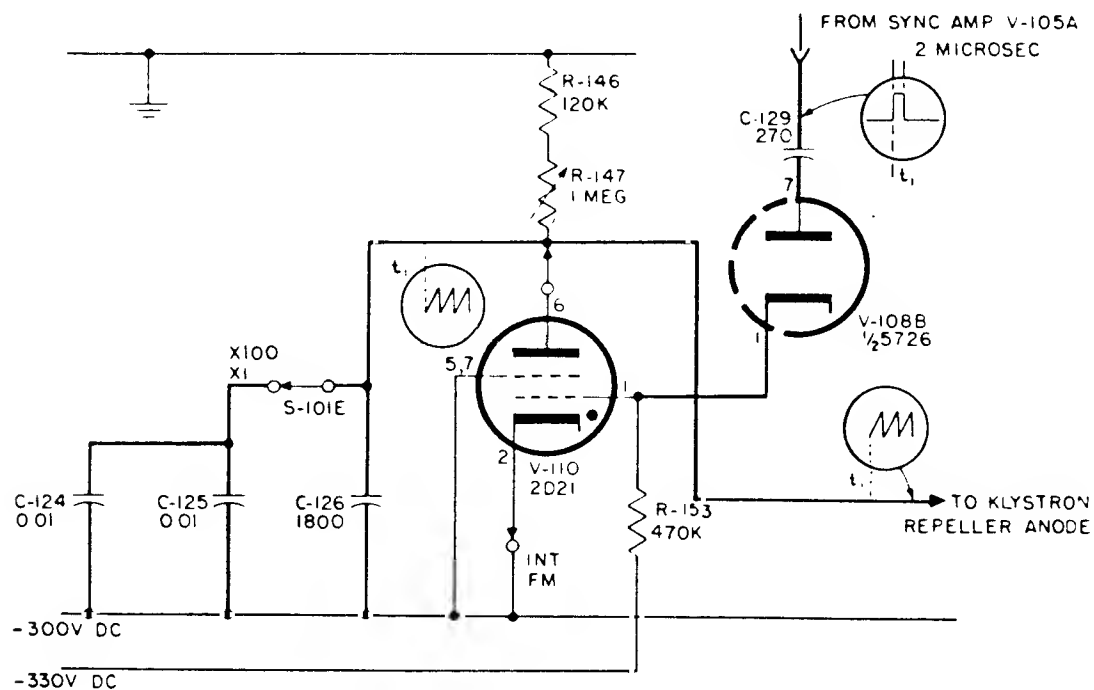


Figure 4-13. Schematic of Frequency-Modulating Circuit

output for the X1 range; while C126, R146 and R147 perform the same function for the X10 range. Resistor R147 is ganged with R111 and R114, and adjusted by the PULSE RATE panel control, so that the FM sweep rate and the internal pulse repetition rate may be controlled by the same control.

4-40. The relaxation oscillator is triggered by a positive pulse from the cathode of the Pulse Shaper and, when activated, delivers a positive-going sawtooth voltage to the repeller, providing frequency modulation.

4-41. THE RF OSCILLATOR.

4-42. REFLEX KLYSTRON. The RF oscillator is a reflex klystron, V114, operating with a tunable coaxial-line resonator. The resonant section is coupled to the resonator grids of the klystron as shown in Figures 4-14 and 4-15 and in the equivalent circuit Figure 4-16.

4-43. Oscillation may be explained by assuming that a small-amplitude RF noise voltage exists across the resonator grids. The electron stream directed through the resonator grids from the cathode is velocity modulated by this small RF voltage. The stream ceases to be uniform, and may be thought of as having some of its electrons accelerated and some retarded. The resultant stream in the drift space past the resonator grids consists of bunches of electrons, and is therefore said to be velocity modulated.

4-44. As this bunched stream (or velocity modulated stream) moves toward the negative-charged repeller it is repulsed back through the resonator grids. Since the stream is bunched, it induces an RF voltage across the grids.

4-45. If the transit time is in phase with the small thermal RF voltage initially assumed to be across the grids, it strengthens the bunching effect on the following stream. Upon reflection, the electron stream following will again strengthen the resonator grid voltage. This process, however, does not continue indefinitely.

4-46. A point is ultimately reached where the fundamental component of the bunching current decreases in magnitude, since energy is now being used to overcome the circuit resistances. There is a point, therefore, where there is just sufficient reflected energy to satisfy the requirements for stable oscillation.

4-47. Assuming that stable oscillation exists when a sudden change in repeller voltage is introduced, the transit time of the electron stream (as it enters and departs the repeller field) is changed. The current bunching effect would change also, and a new RF voltage would be produced across the resonator grids. This velocity modulation then changes the circuit oscillating frequency.

4-48. The situation previously described is valid for relatively small variations in repeller voltage. Excessive variations alter the relationship between the resonator voltage and the transit time of the electron stream, producing dead spots (no oscillation) or conditions of oscillation in undesired modes.

4-49. The term mode, in this sense, describes two different but interrelated characteristics. One mode is the characteristic of the cavity (or line-section resonator), which is resonant at a series of frequencies when the effective electrical length of the line is $1/4$ wavelength, $3/4$ wavelength, or $5/4$ wavelengths. These effective electrical lengths are termed resonator modes.

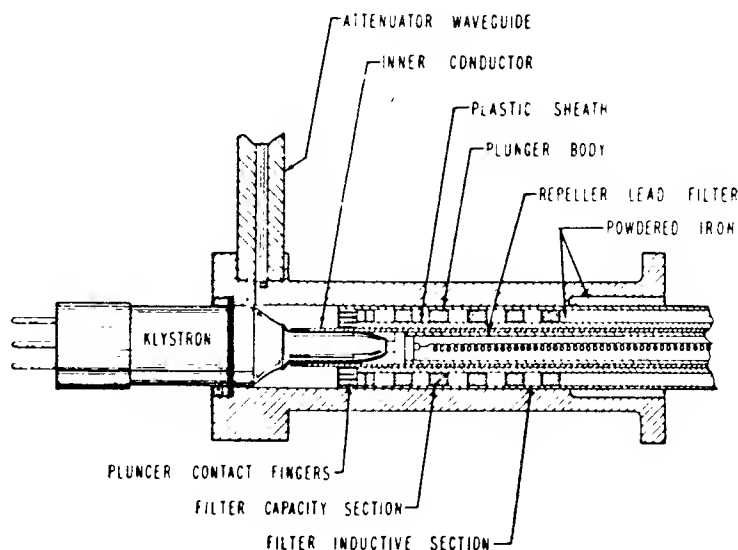


Figure 4-14. Cross-Section of RF Oscillator (620B)

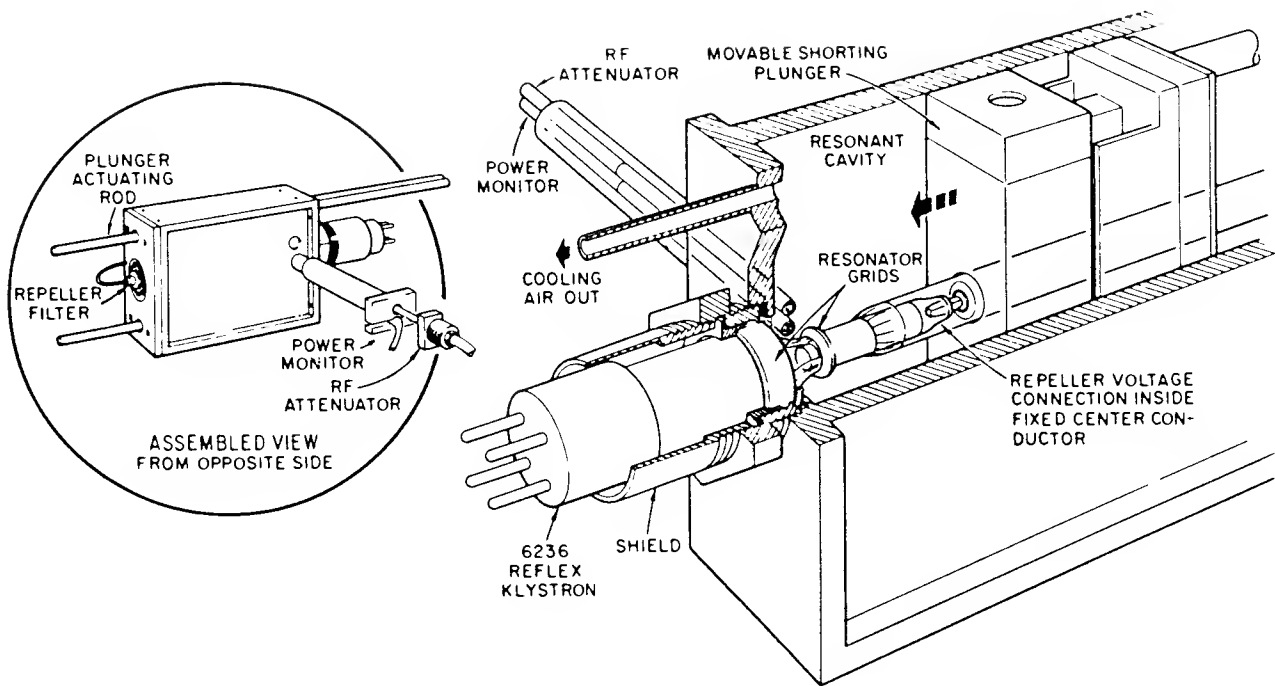


Figure 4-15. Cross-Section of RF Oscillator (618C)

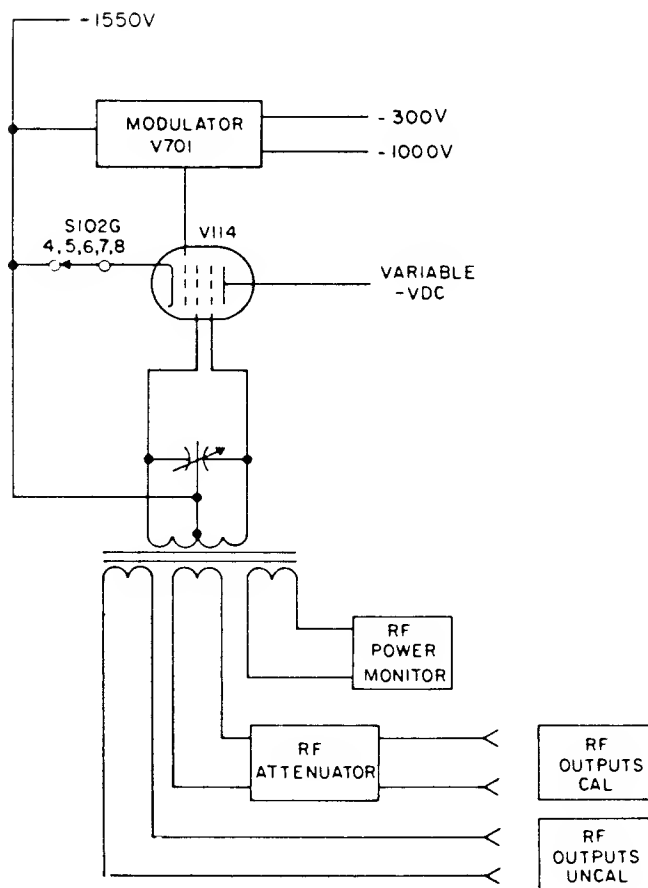


Figure 4-16. Equivalent Circuit of RF Oscillator

4-50. Another mode is the repeller mode, which describes the round-trip transit time of the electron stream as expressed in the cycles of RF voltage across the resonator grids. Oscillations most easily occur when the transit time equals $3/4$, $1-3/4$, $2-3/4$, $3-3/4$, $4-3/4$. . . RF cycles. These repeller modes are distinguished by different transit times rather than by different resonant frequencies, and they are functions of repeller voltages. Generally, the value of the repeller voltage increases for a given mode as the mean klystron frequency is increased.

4-51. When a specific repeller mode is desired throughout a given band of frequencies, the repeller voltage is adjusted against the plunger travel (of a tunable resonator, for example) to maintain the relative transit time. Since the repeller mode is a function of transit time, it also remains constant.

4-52. A third use of the term mode is the oscillation mode, which is defined in terms of the repeller mode and the cavity mode. For example, an oscillation mode might be $3/4$ wavelength cavity and $3-3/4$ wavelength repeller.

4-53. **REPELLER VOLTAGE CONTROL (618C).** The operating characteristics of a reflex Klystron are such that an optimum value of repeller voltage exists for each operating frequency. This voltage is the value that will cause the bunched electrons to return to the resonator grids at the proper time. Figure 4-17 shows the repeller voltage characteristics for the Klystron over the range employed in the Signal Generator.

4-54. The repeller voltage characteristic shown in Figure 4-17 provides for operation in the 2-3, 4 repeller mode. The required voltage for optimum operation

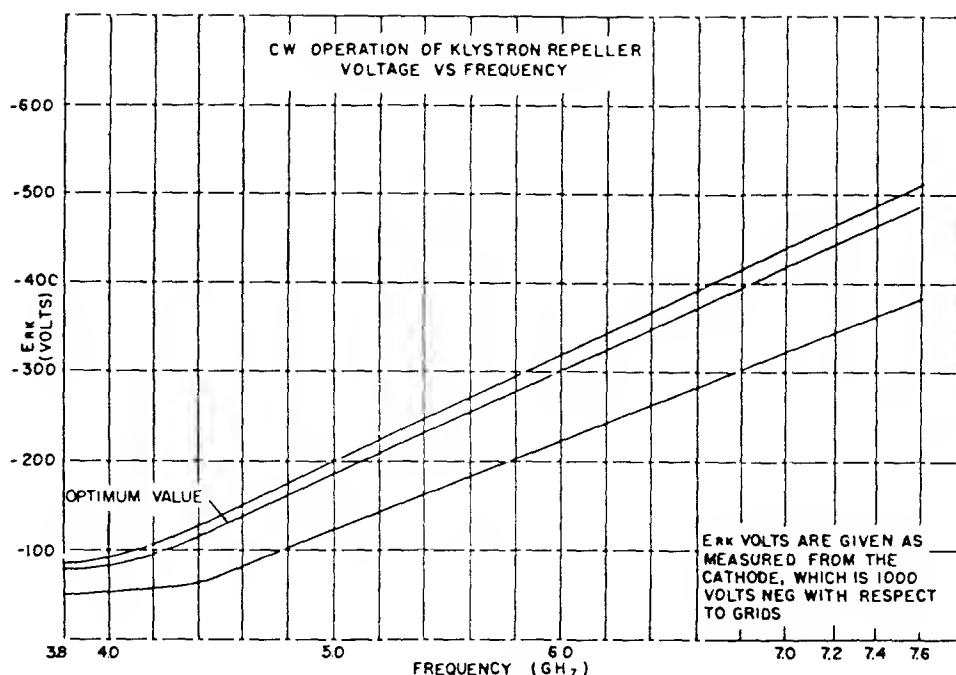


Figure 4-17. Repeller Voltage Versus Frequency (618C)

is essentially linear with frequency for the frequency range above 4400 MHz. In the frequency range from 3800 to 4400 MHz the required voltage is not a linear function of frequency but is slightly curved as shown.

4-55. Figure 4-18 shows the 618C circuit that provides negative voltage to the repeller. Potentiometer R174 is a 100,000-ohm wirewound potentiometer that is mechanically ganged with the mechanism that tunes the resonant line, providing a proper voltage to the repeller electrode as the frequency is changed. The values of the resistor R170 and R175 are adjustable to establish the voltage applied across the tracking potentiometer, R174. The values of resistors R173 and R178 are adjustable to provide the required curvature in the repeller voltage characteristic below 4400 MHz.

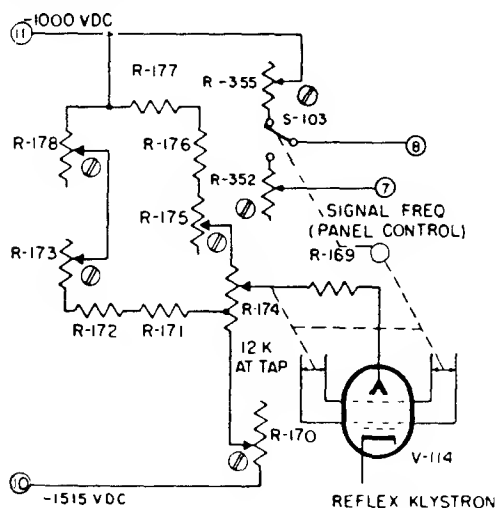


Figure 4-18. Schematic of Repeller Tracking Circuits (618C)

4-56. The ΔF control, R523, is part of a voltage-divider network (R520-R525) that parallels the klystron. Variation of R523 causes small changes in the klystron repeller voltage and thus small changes in the frequency of oscillation.

4-57. **PARALLEL-PANEL RESONATOR (618C).** The resonator employed in the Model 618C is known as a parallel-plane resonant line. In its physical shape it resembles a rectangular box type cavity with a circular center element and a rectangular plunger to vary the cavity depth. Actually, the line is a direct development from a circular coaxial line as shown in Figure 4-19.

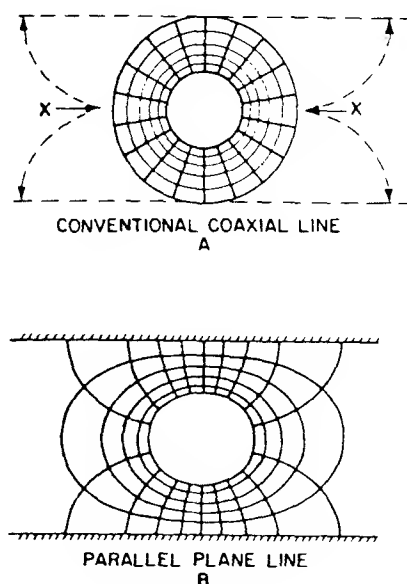


Figure 4-19. Field Configuration of Coaxial and Parallel-Plane Lines (618C)

Part A of Figure 4-19 shows such a line, and the field configurations that exist when it is excited electrically. The resonant frequency of such a line with one end shorted is determined by its electrical length in a direction parallel to the center conductor. The other dimensions of the line play a very small part in determining the oscillating frequency.

4-58. The evolution of the parallel-plane line from the coaxial line may be described by reference to Figure 4-19, parts A and B. Assume the outer conductor were cut at the points X and the two semi-lines thus created were flattened out as shown by the horizontal dotted lines. The voltage and current configurations would then take the form shown in part B. To carry this example through in complete detail, the cross-section of the center conductor would take a slightly elliptical form of perfect configurations. However, for practical purposes, this is not necessary, and a circular center conductor is used.

4-59. The line, as shown in Figure 4-19, part B, is not enclosed on the short sides, and it is possible to operate it in this manner. However, sides are provided to prevent stray RF leakage currents.

4-60. The parallel-plane line depends, for its resonant frequency, upon its electrical length and consequently may be tuned by simple mechanical means and can be directly calibrated. This type of cavity provides a resonator in which simple and straight-forward methods can be employed to provide broadband suppression of the various parasitic resonances that occur when other physical dimensions approach the frequency-determining electrical dimensions.

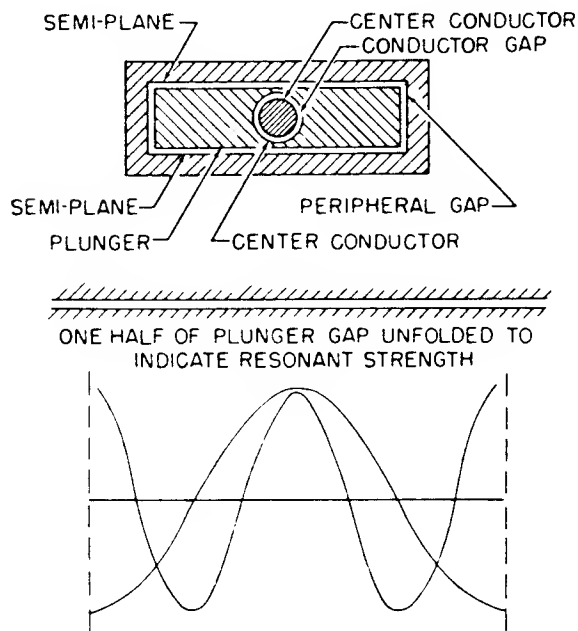


Figure 4-20. Plunger Resonances in Uncompensated Parallel-Plane Line Resonator (618C)

4-61. Figure 4-20 shows a cut-away view of the resonant line and the other components of the parallel-plane oscillator. The klystron is mounted so that one of the resonator grids is coupled to the two semi-lines while the other is coupled to the circular center conductor. The repeller voltage is applied through an insulated filter in the center conductor while the other potentials required to operate the tube are applied through the tube base pins.

4-62. **PLUNGER RESONANCE (618C).** The plunger employed in the parallel-plane resonator is of the non-contacting type and a small air gap exists between the periphery of the plunger and the surfaces of the semi-planes and sidewalls, as shown in Figure 4-20.

4-63. The gap has a physical length of approximately 17 centimeters, and an electrical length such that it has a two-cycle and a four-cycle resonant frequency occurring near or in the frequency range of the oscillator. As shown in Figure 4-20, these frequencies correspond to one-half and one-quarter of the electrical length of the periphery of the plunger. A similar gap exists between the center conductor and the plunger. However, the length of this gap is such that no resonances occur in the frequency range of the oscillator.

4-64. Compensation is applied to control resonance of the line formed by the peripheral plunger gap in the resonator.

4-65. **REPELLER ACTION (620B).** As seen in Figure 4-21, the repeller mode for the Model 620B shifts from the 3-3/4 mode to the 4-3/4 mode.

4-66. The 3-3/4 repeller mode is used for the 7- to 9-GHz range, and the 4-3/4 repeller mode is used above 9 GHz.

4-67. The repeller voltage is controlled by a tapered potentiometer ganged to track with the frequency-tuning plunger; it includes a switch which steps the repeller voltage less negative at approximately 8800 GHz to change the transit time to 4-3/4 RF cycles.

4-68. The ΔF control, R523, is part of a voltage-divider network (R520-R525) that parallels the klystron. Variation of R523 causes small changes in the klystron repeller voltage and thus small changes in the frequency of oscillation.

4-69. **RESONATOR (620B).** The cavity resonator for the klystron is a tunable coaxial line with a shorting plunger. The repeller voltage, plunger, and frequency dial are gang-tuned.

4-70. The resonant frequency for a circular coaxial resonator with one end shorted, is determined by the electrical length of the resonator in a direction parallel to the center conductor. The other dimensions of the line are almost negligible in determining the fundamental frequency of the section.

4-71. **UNDESIRE MODE SUPPRESSION (620B).** Cavity resonator systems have a tendency to operate in the 1 1/4-wavelength cavity mode, and from an efficiency and power output standpoint it is

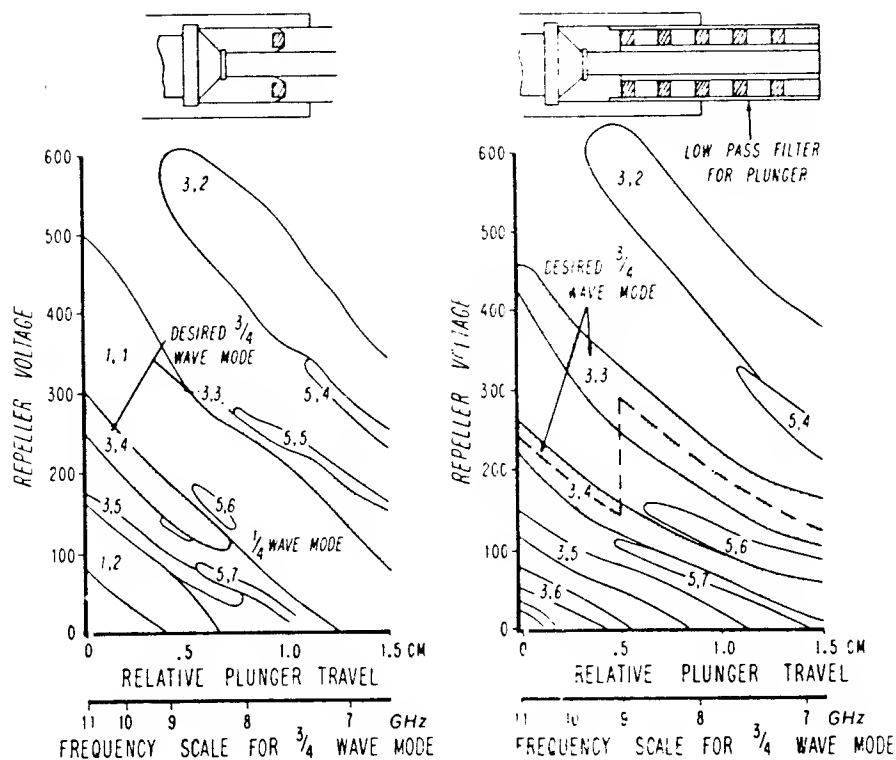


Figure 4-21. Uncompensated and Compensated Mode Structure (620B)

advantageous to operate in the $1/4$ -wavelength cavity mode. As the desired frequency increases, however, operation in this mode is not always feasible.

4-72. As the desired frequency increases, a $1/4$ -wavelength becomes quite small and plunger placement in the cavity becomes extremely critical and imposes mechanical limitations, making it necessary to select another mode of operation. The $3/4$ -wavelength cavity mode is employed for the range of the Model 620B.

4-73. As seen in Figure 4-21 the dominant effects of the $1/4$ -wavelength mode consist of undesirable mode interference. A study of this $1/4$ -wavelength cavity and $1-3/4$ repeller mode showed that its frequency was below 6000 MHz, considerably below the 7000 MHz low end of the Model 620B. Advantageous use was made of this fact, and the plunger was designed to incorporate a concentric low-pass filter having a cutoff frequency of 6500 MHz.

4-74. **PLUNGER CONSTRUCTION (620B).** As seen in Figure 4-14, the space between the center conductor of the resonant line and the inner wall of the plunger consists of a number of high- and low-impedance sections in cascade. This constitutes the filter section, which is terminated in back of the plunger with powdered iron to absorb the energy passed by the filter.

4-75. The effectiveness of this approach to the suppression of the undesired mode is seen in Figure 4-21. The filter prevents the undesired mode from supporting itself; the first section of the filter appears as a low impedance for the higher frequencies of the desired modes. In effect, the klystron tube sees a term-

inated transmission line at frequencies below 6500 MHz. For frequencies above 6500 MHz, the klystron sees a shorted, tunable, high Q resonator.

4-76. The plunger makes contact with the outer conductor wall by means of long-life contact fingers. Peripheral resonances are suppressed by leading the gap between the plunger and the outer wall with a dielectric plastic sheath. The technique effectively lowers the frequency of the parasitics to a range much lower than that of the generator.

4-77. **THE ATTENUATOR (618C).** Three pickup loops are located in the resonator to collect RF power. The first is the output attenuator loop which couples the calibrated power to be supplied by the generator to the load through an output connector on the panel; the position of this loop is adjustable so that the output power level may be varied as desired. The second is the power level in the oscillating circuit and establishes a reference point to calibrate the output power. The last pickoff loop provides a source of uncalibrated RF power at a front-panel connector.

4-78. Power is coupled to the load from the RF oscillator by a coupling loop located at a suitable point in the resonant line. This loop slides in a circular waveguide section. The cross-section of the waveguide is very small in relation to the frequencies of operation, and normal propagation down the waveguide will not take place. However, some limited propagation does take place, and the power level decreases exponentially as the distance from the resonant line increases. Thus it is possible, by moving a pickup loop linearly in the waveguide, to secure an output that varies in decibels in proportion to the linear travel.

4-79. This type of attenuator is known as an attenuator of the cutoff type and its characteristics are employed so that the pick-up probe and indicating dial can be moved by a simple gear train and the dial may be calibrated directly in decibels.

4-80. A cross-section of the attenuator and RF pick-up loop is shown in Figure 4-22. The RF pick-up loop is terminated by a special resistor, which is made by coating platinum on a glass bead. This resistor is used to match the attenuator to the output cable, and its dc resistance is approximately 50 ohms.

4-81. The polyiron section on the outside of the probe is designed to absorb power that may leak past the probe in the space between the outer conductor and the waveguide walls.

4-82. **THE ATTENUATOR (620B).** The attenuator in the Model 620B is direct reading and requires no frequency correction. It is essentially a piston probe sliding in a waveguide beyond cutoff.

4-83. Theoretically, the high frequencies beyond cutoff involved in such a waveguide demand dimensions which would be smaller than practical. Consequently the dimensions used have been increased in favor of practical design. Since the dimensions have been increased, there is a slight error introduced because the frequency-versus-attenuation characteristic is not sharp at the cutoff frequency.

4-84. This error is compensated by distributing it over the frequency and the attenuation ranges of the instrument. The compensation is effected by first halving the error by calibrating the attenuator in the middle of the frequency band (approximately 9 GHz). The half-error now exists at the extremes of the band only.

4-85. The net attenuator power-monitor error is less than the maximum error of the instrument, which must allow for the connector mismatches and a source impedance that is not the ideal 50 ohms resistance presented by the pick-up strip on the attenuator probe (Figure 4-23).

4-86. The small dimensions of the waveguide beyond cutoff necessitated careful design of the pickup loops on the power monitor and attenuator probes. The construction details are shown in Figure 4-24.

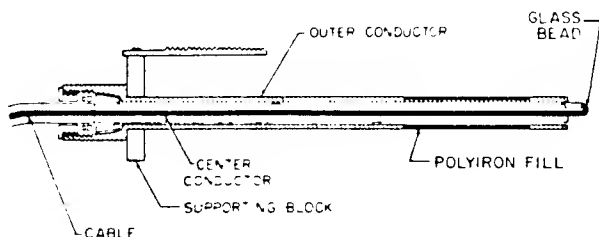


Figure 4-22. Cross-Section View of Attenuator Probe (618C)

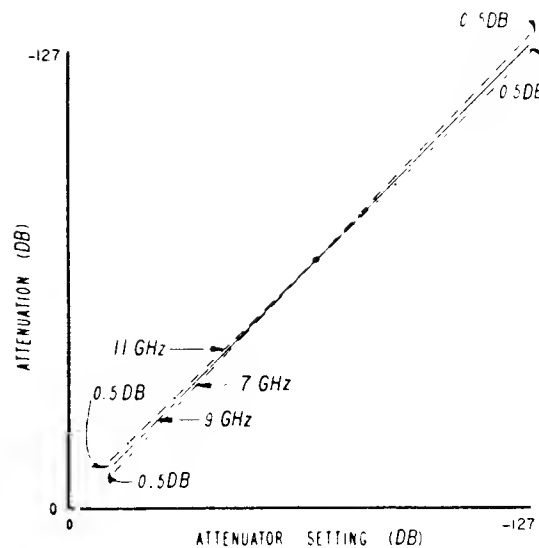


Figure 4-23. Compensation of Attenuator (620B)

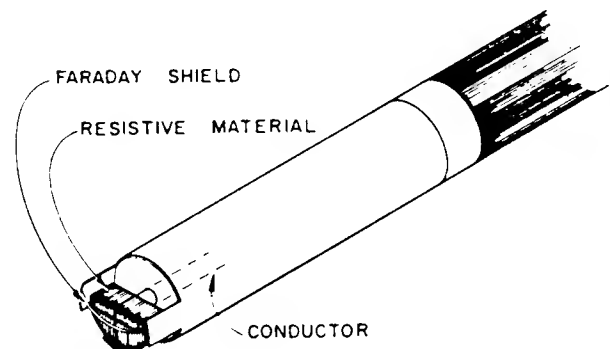


Figure 4-24. Construction Details of Power Monitor Probe (620B)

4-87. THE POWER MONITOR.

4-88. The power monitor circuit is provided to measure and indicate the level of the RF power at the attenuator input.

4-89. The position drive for the attenuator probe is coupled to the calibrated dial, while the drive for the power monitor is coupled to an index which moves around the outside of the calibrated dial. The power monitor probe is nearly a duplicate of the attenuator probe, except that the power picked up by the monitor probe is supplied to a Diode Detector. Figures 4-24 and 4-25 show the 620B power monitor probe. The output of the detector is applied to the Power Monitor Section (Figure 4-26).

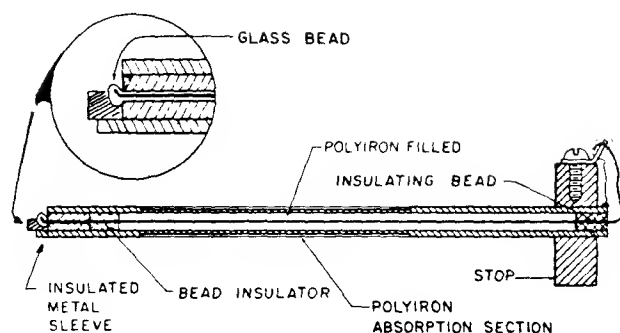


Figure 4-25. Cross-Section View of Power Monitor Probe (620B)

4-90. The Power Monitor Section is composed of a Differential Amplifier acting as a Voltage Comparator. The Differential Amplifier consists of transistors Q601 and Q602 (each a dual-section transistor, with each section in a cascade arrangement), and transistor Q603 acting as a current-feedback generator to increase the input impedance and thus decrease the loading effect on the detected RF signal. The reference input to the differential amplifier is the voltage drop across diode CR602, while the signal to be compared is the detected RF signal. A voltage proportional to the difference in the two input voltages appears between the emitters of Q601A and Q602A, causing the power meter to deflect and indicate the relative power level of the signal Generator output. Potentiometer R612 is the zero-set adjustment for the meter and is adjusted with the MOD. SELECTOR set to OFF (no RF output).

4-91. THE POWER SUPPLIES.

4-92. GENERAL OPERATING PRINCIPLES

4-93. All the dc operating voltages are electronically regulated. Some are obtained directly from regulated supplies, others are derived by voltage division from regulated supplies.

4-94. There are three electronic regulators supplying -300, -1000, and -1550 V. It should be noted that the three power supplies actually develop -300, -700, and -500 V dc; series connection of these voltages results in -300, -1000, and -1550 V. All of the regulators operate as follows. As shown in Figure 4-27, a regulating element (Series Regulator) is connected in series with the load and the dc power source (Rectifier and Voltage Doubler). The resistance of the regulating element is made adjustable so that the voltage at its output will be adjustable. The resistance is adjusted by a control voltage; the higher the control voltage, the higher the output voltage. A sample of the Series Regulator output voltage is compared against a dc reference voltage by a Comparison Amplifier and the difference voltage is inverted and applied to the Series Regulator. As a result, any tendency for the output voltage to change is immediately counteracted by the control voltage, and the supply output voltage remains constant.

4-95. Since the gain of the Comparison Amplifier determines the degree of regulation, it may be followed by an additional Control, or Driver, Amplifier to improve regulation. The Comparison Amplifier is a

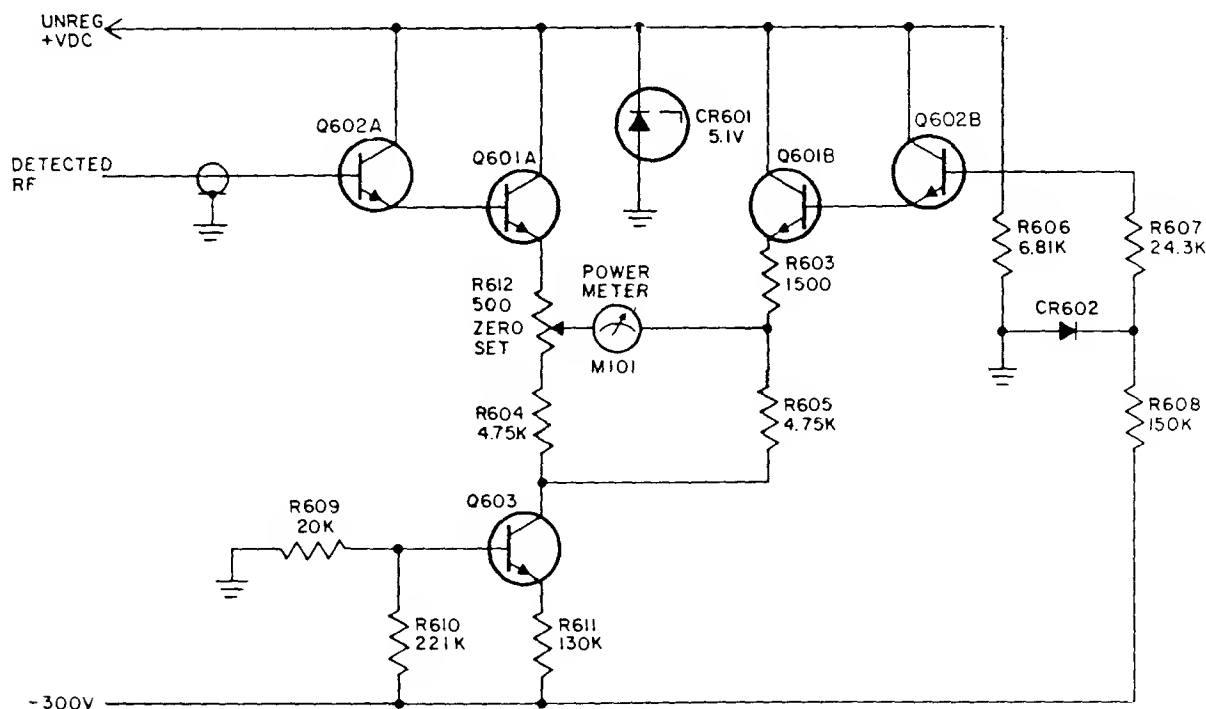


Figure 4-26. Schematic of Power Monitor Circuit

differential type for temperature stability. The dc reference voltage used for comparison is obtained from voltage-regulator electron tubes, from semiconductor voltage-reference diodes, or from another regulated power supply. When an adjustable power supply is used as the reference for another supply, changing its output level also changes the level of the supply for which it is the reference. Consequently, if this reference varies drastically, the output levels of both supplies change.

4-96. -300 VOLT SUPPLY.

4-97. The -300 V supply operates as explained under General Operating Principles. The reference for this supply (applied to the cathodes of V304 through resistor R375) is obtained from the -1000 V supply. In this power supply the Control (Driver) Stage is, like the Comparison Amplifier, a Differential-Type Amplifier.

4-98. -1000 VOLT SUPPLY.

4-99. The -1000 V supply operates as explained under General Operating Principles, and derives its reference from V402. The Comparison Amplifier, V403 and 404, drives the Series Regulator directly. The Regulator receives its screen voltage from regulator tube V305, which, in turn, uses the -300 V supply as a B+ source; consequently, any drastic variation of the -300 V supply will affect the -1000 V supply.

4-100. -1550 VOLT SUPPLY.

4-101. The -1550 V supply operates as explained under General Operating Principles, and derives its reference from V502. The Comparison Amplifier, V503 and V504, drive the Series Regulator directly. The Series Regulator receives its screen voltage from a voltage divider (R514, R515) across the -300 and -1000V supplies; hence, any drastic variation in either of these two supplies will affect the -1550 V supply.

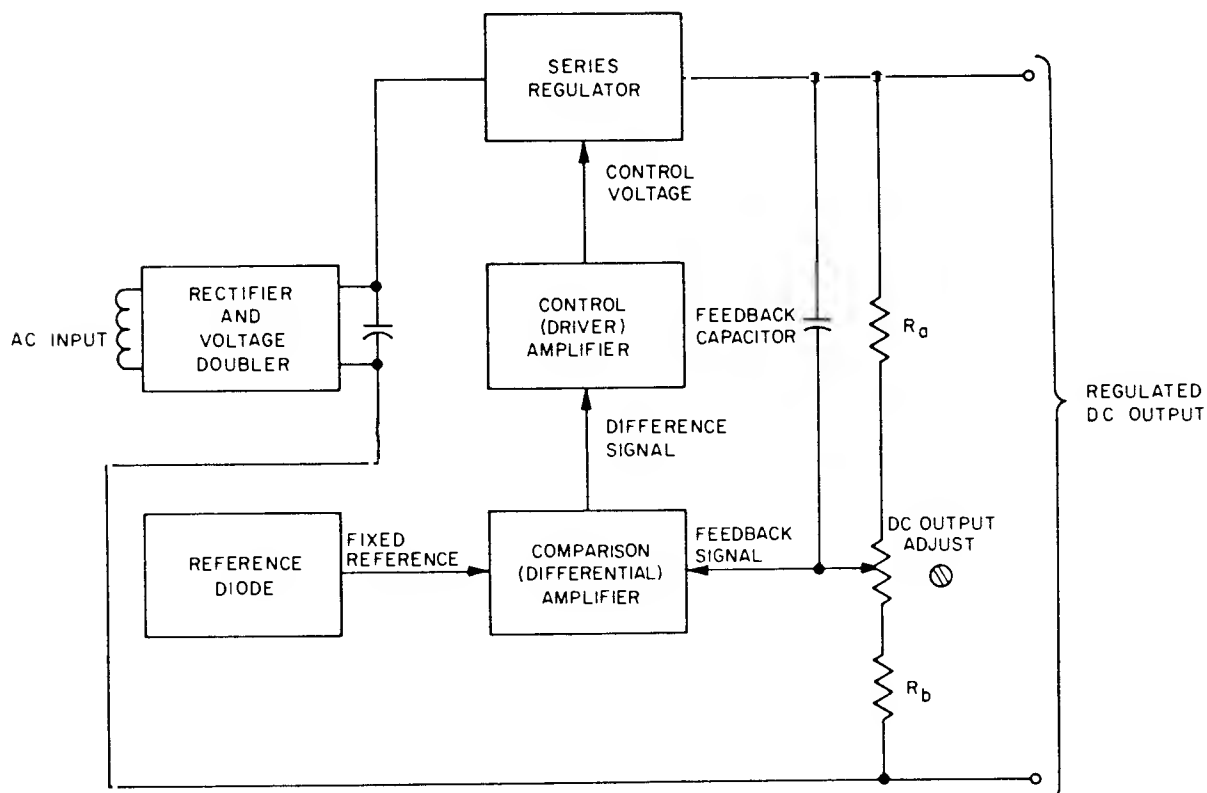


Figure 4-27. Power Supply Block Diagram

Table 5-1. Test Equipment Required for Performance Testing

| Instrument | Critical Specification | Recommended Models |
|-----------------------------|--|-----------------------|
| Thermistor Mount | Frequency range: 3.8 to 11 GHz SWR: 2.0 max | HP 8481A |
| Power Meter | Power range: 0 to -30 dBm Accuracy: $\pm 3\%$ | HP 435A |
| Adjustable Transformer | Output voltage range: 103.5-126.5 and 207-253 volts ac | General Radio W10MT3A |
| Microwave Frequency Counter | Accuracy: ± 1 count ± 3 parts in 10^9 Frequency range: 30 Hz to 12 GHz | HP 5342A |
| Oscilloscope | Vertical sensitivity: 0.05V/cm Bandwidth: 50 MHz | HP 1740A |
| Crystal Detector | Frequency range: 3.8 to 11 GHz Frequency response: ± 0.5 dB per octave SWR: 1.5 | HP 423A |
| Oscillator | Frequency range: 40 Hz to 4 kHz Voltage output: 0 to 10 volts rms Frequency Accuracy: $\pm 2\%$ | HP 200CD |
| Vacuum Tube Voltmeter | Range: 0 to 10 volts ac Accuracy: $\pm 3\%$ of full scale | HP 410C |
| Pulse Generator | Frequency range: 1000 Hz Voltage output ± 20 and ± 70 volts peak Pulse width: 0.5 and 2500 micro-seconds | HP 214B |
| Spectrum Analyzer | Frequency Range: 3.8 to 11 GHz IF Bandwidth: 10 kHz | HP 8565A |

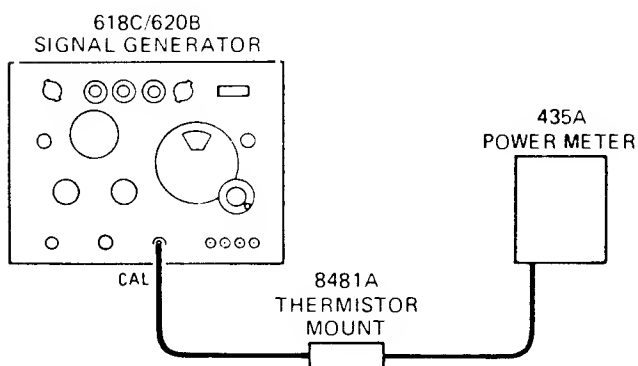


Figure 5-1. Setup for Testing RF Output Accuracy

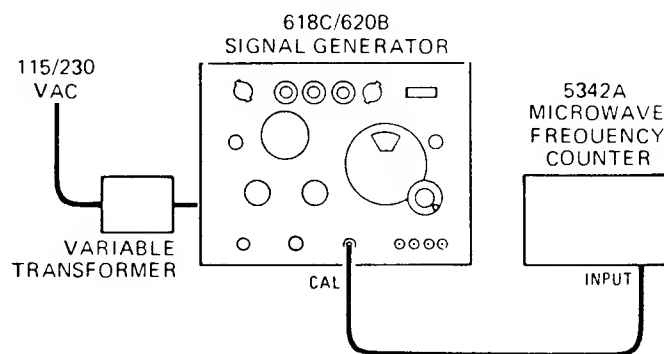


Figure 5-2. Setup for Testing Frequency Accuracy

SECTION V MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides instructions for performance testing, calibrating, troubleshooting, and repairing the Signal Generator.

5-3. MAINTENANCE PRECAUTIONS.

WARNING

VOLTAGES IN EXCESS OF 1550 VOLTS INSIDE CABINET. USE EXTREME CARE WHEN SIGNAL GENERATOR IS REMOVED FROM CABINET.

5-4. PERIODIC INSPECTION.

5-5. CLEANING.

5-6. If the equipment has been subjected to unusual conditions (excessive moisture, dust, heat, vibration, etc.) it is suggested that the instrument be removed from the cabinet and inspected for dirt or moisture accumulation, loosened components, or any possible sign of damage. Forced air under medium pressure is recommended for dusting and drying, although care must be taken not to vary the settings of the internal-adjustment potentiometers and components during the process. Inspect the air filter regularly and, if necessary, remove and wash in detergent and water. Dry filter and replace: no oiling or coating of the filter is necessary. Unrestricted air flow gives longest component life. Keep the filter clean.

5-7. LUBRICATION.

5-8. No routine lubrication is needed. Lubricate mechanical parts (frequency drive gears, drive mechanism) only when necessary, using a light machine oil. Lubricate moving parts, such as the attenuator and power-monitor probe rack gears, with dry molybdenum or graphite lubricant. The cavity plunger is permanently lubricated during manufacture and requires no subsequent lubrication.

5-9. PERFORMANCE TESTS.

5-10. PURPOSE.

5-11. The following paragraphs check performance for incoming inspection, periodic evaluation, troubleshooting, and calibration. The tests can be performed without access to the Signal Generator interior. The specifications of Table 1-1 are the performance standards.

5-12. TEST EQUIPMENT REQUIRED.

5-13. The test instruments required to make the performance tests are listed in Table 5-1. Test instruments other than those listed may be used provided performance equals or exceeds Critical Specifications.

5-14. RF POWER-OUTPUT ACCURACY CHECK:

a. Connect Signal Generator in test setup shown in Figure 5-1.

b. Set Signal Generator controls as follows:

| | |
|---------------------|------|
| LINE | ON |
| MOD. SELECTOR | CW |
| POWER SET | 0 |
| OUTPUT ATTN | 0 dB |

c. Adjust 618C Signal Generator frequency control from 3.8 to 7.6 GHz; Power Meter should indicate 0 ± 3 dBm (reset POWER SET to 0 before each reading).

c. Adjust 620B Signal Generator frequency control from 7 to 11 GHz; Power Meter should indicate 0 ± 3 dBm (reset POWER SET to 0 before each reading).

d. Adjust OUTPUT ATTN control from 0 to -30 dBm in 1-dB steps; Power Meter indication should agree with OUTPUT ATTN setting ± 3 dBm from 0 to -7 dBm and ± 2 dBm from -7 to -30 dBm.

5-15. FREQUENCY ACCURACY, STABILITY, AND ΔF CHECK.

a. Connect Signal Generator in test setup shown in Figure 5-2.

b. Adjust variable transformer for 115 (or 230) V.

c. Set Signal Generator controls as follows:

| | |
|------------------------|----------|
| LINE | ON |
| MOD. SELECTOR | CW |
| Frequency (618C) | 3.8 GHz |
| Frequency (620B) | 7 GHz |
| POWER SET | 0 |
| ΔF | Centered |

d. Adjust Signal Generator OUTPUT ATTN control for sufficient output to drive Microwave Frequency Counter.

e. Adjust Microwave Frequency Counter to measure frequency.

f. (618C.) Microwave Frequency Counter shall indicate 3.762 to 3.838 GHz; record indication.

f. (620B.) Microwave Frequency Counter shall indicate 6.930 to 7.070 GHz; record indication.

g. (618C.) Adjust variable transformer for 103.5 (or 207) V; Microwave Frequency Counter indication should be within 0.76 MHz of indication recorded in step e.

g. (620B.) Adjust variable transformer for 103.5 (or 207) V; Microwave Frequency Counter indication should be within 1.4 MHz of indication recorded in step e.

h. (618C.) Adjust variable transformer for 126.5 (or 253) V; Microwave Frequency Counter indication should be within 0.76 MHz of indication recorded in step e.

h. (620B.) Adjust variable transformer for 126.5 (or 253) V; Microwave Frequency Counter indication should be within 1.4 MHz of indication recorded in step e.

i. (618C.) Repeat steps c through h for Signal Generator frequencies of 5.7 and 7.6 GHz. Refer to the following table for proper indications:

i. (620B.) Repeat steps c through h for Signal Generator frequencies of 9 and 11 GHz. Refer to the following table for proper indications:

| 618C Signal Generator Frequency | Line Voltage | | |
|---------------------------------|------------------|----------------|----------------|
| | 115/230 | 103.5/207 | 126.5/253 |
| 5.7 GHz | 5.653-5.7057 GHz | ± 1.04 MHz | ± 1.04 MHz |
| 7.6 GHz | 7.524-7.676 GHz | ± 1.52 MHz | ± 1.52 MHz |

| 620B Signal Generator Frequency | Line Voltage | | |
|---------------------------------|-------------------|---------------|---------------|
| | 115/230 | 103.5/207 | 126.5/253 |
| 9 GHz | 8.910-9.090 GHz | ± 1.8 MHz | ± 1.8 MHz |
| 11 GHz | 10.890-11.110 GHz | ± 2.2 MHz | ± 2.2 MHz |

j. Adjust transformer for 115 (or 230) V.

k. Adjust ΔF control to extreme ccw position.

m. (618C.) Adjust Signal Generator frequency control to 3.8 GHz.

m. (620B.) Adjust Signal Generator frequency control to 7 GHz.

n. Measure Signal Generator frequency on Microwave Frequency Counter; record reading.

p. Adjust ΔF control fully cw, and measure Signal Generator output frequency; frequencies measured in this step and step n must differ by approximately 0.5 MHz for 618C; 1.5 MHz for 620B.

5-16. UNCALIBRATED RF OUTPUT CHECK.

a. Connect Signal Generator in test setup shown in Figure 5-1 but connect Thermistor Mount input to RF OUTPUTS UNCAL connector.

b. Set Signal Generator controls as follows:

LINE ON
MOD. SELECTOR CW

c. (618C.) Adjust Signal Generator frequency control from 3.8 to 7.6 GHz; Power meter should indicate 0.3 mW minimum over frequency range.

d. (620B.) Adjust Signal Generator frequency control from 7 to 11 GHz; Power meter should indicate 0.3 mW minimum over frequency range.

5-17. INTERNAL PULSE-MODULATION CHECK.

a. Connect Signal Generator in test setup shown in Figure 5-3.

b. Set Signal Generator controls as follows:

LINE ON
MOD. SELECTOR INT
SYNC SELECTOR X1
PULSE RATE 40

c. Microwave Frequency Counter should indicate 40 ± 10 Hz.

d. Adjust PULSE RATE control to 400; counter should indicate 400 ± 100 Hz.

e. Set SYNC SELECTOR to X10; counter should indicate 4000 ± 1000 Hz.

f. Adjust PULSE RATE control to 40; counter should indicate 400 ± 100 Hz.


g. Adjust PULSE WIDTH control from extreme ccw to cw position and observe Oscilloscope; width of pulses should vary from 0.5 to 10 μ s (50% points). Pulse width error should not exceed ± 1 μ s from 1 through 5 and $\pm 20\%$ from 6 through 10.

h. Set oscilloscope time base for 1 μ sec/cm. Adjust the PULSE DELAY control to its extreme CCW position and observe the oscilloscope. Pulse delay should be less than 3 μ sec from left side of CRT. Set oscilloscope for 50 μ sec/cm and adjust PULSE DELAY control fully CW. Pulse delay should be greater than 300 μ secs.

5-18. INTERNAL SQUARE-WAVE MODULATION CHECK.

a. Connect Signal Generator in test setup shown in Figure 5-3.

b. Set Signal Generator controls as follows:

LINE ON
MOD. SELECTOR 
SYNC SELECTOR X1
PULSE RATE 40

c. Microwave Frequency Counter should indicate 40 ± 10 Hz and Oscilloscope should indicate symmetrical square wave.

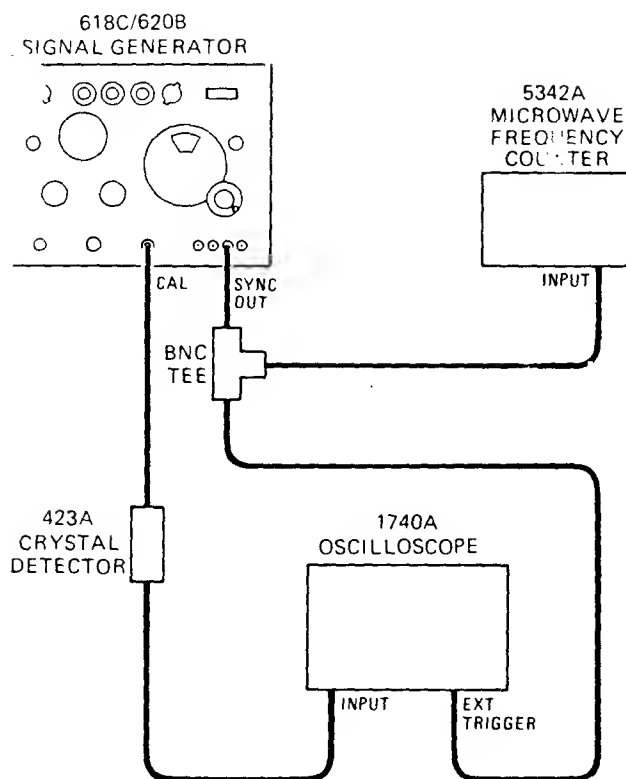


Figure 5-3. Setup for Testing Internal Pulse Modulation

d. Adjust PULSE RATE control to 400; counter should indicate 400 ± 100 Hz.

e. Set SYNC SELECTOR to X10; counter should indicate 4000 ± 1000 Hz.

f. Adjust PULSE RATE control to 40; counter should indicate 400 ± 100 Hz.

5-19. EXTERNAL PULSE CHECK.

a. Connect Signal Generator in test setup shown in Figure 5-4.

b. Set Signal Generator controls as follows:

| | |
|---------------------|------|
| LINE | ON |
| MOD. SELECTOR | +EXT |
| POWER SET | 0 |
| OUTPUT ATTEN | 0 dB |

c. Adjust Pulse Generator for a +20 V peak, 1000-Hz output with a pulse width of $0.5 \mu\text{s}$.

d. The Oscilloscope should display $0.5 \mu\text{s}$ pulses at a 1000 Hz rate switching from 0V to the "on" level (determined by Signal Generator's OUTPUT ATTEN setting).

e. Adjust Pulse Generator for +70V peak output. Display should be the same as in step d.

f. Adjust Pulse Generator for $2500 \mu\text{s}$ pulses at a 100 Hz rate.

g. The Oscilloscope should display $2500 \mu\text{s}$ pulses at a 100 Hz rate switching from 0V to the "on" level.

h. Adjust Pulse Generator for +20V peak output. Display should be the same as in step g.

i. Set MOD. SELECTOR to -EXT.

j. Repeat steps c through h with pulse generator adjusted to negative pulse output.

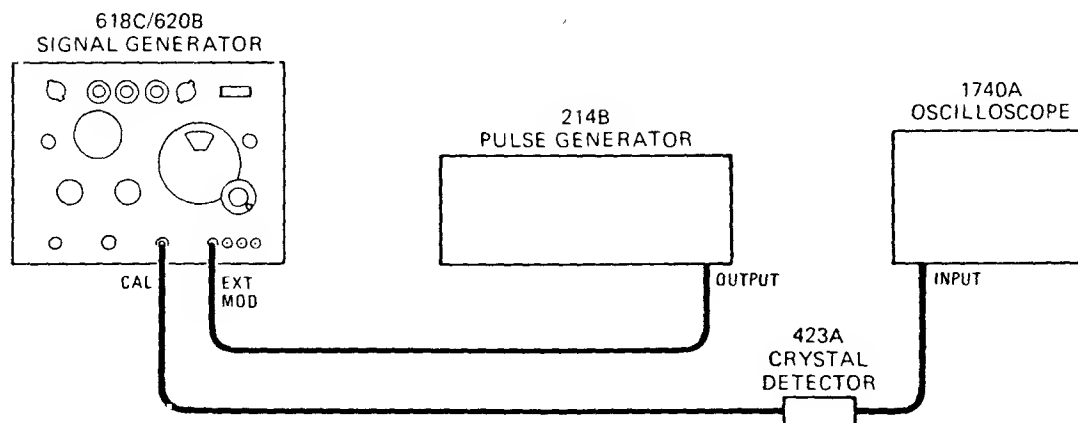


Figure 5-4. Setup for Testing External Pulse Modulation

5-20. INTERNAL FM CHECK.

a. Connect Signal Generator in test setup shown in Figure 5-5 without the oscillator in the setup.

b. Set Signal Generator controls as follows:

```

LINE ..... ON
MOD. SELECTOR ..... INT. FM
Frequency (618C) ..... 5 GHz
Frequency (620B) ..... 7 GHz
POWER SET ..... 0
OUTPUT ATTEN ..... 0 dBm
SYNC SELECTOR ..... X10
PULSE RATE (1000 pps) ..... 100
FM AMPLITUDE ..... max ccw

```

c. Advance FM amplitude control in clockwise direction until the display indicates maximum FM deviation without unstable operation. FM deviation should be 5 MHz p-p minimum.

d. Repeat step c at desired frequencies. FM deviation should be 5 MHz minimum over most of band.

e. Set SYNC SELECTOR to X10.

f. Set PULSE RATE control 50.

g. Repeat steps c and d.

5-21. EXTERNAL FM CHECK.

a. Connect Signal Generator in test setup shown in Figure 5-5.

b. Set Signal Generator controls as follows:

```

LINE ..... ON
MOD. SELECTOR ..... EXT. FM
Frequency (618C) ..... 5 GHz
Frequency (620B) ..... 7.0 GHz
POWER SET ..... 0
OUTPUT ATTEN ..... 0 dBm
FM AMPLITUDE ..... max ccw

```

c. Adjust Oscillator output for maximum at 1000 Hz.

d. Advance FM AMPLITUDE control in clockwise direction until display indicates maximum FM deviation without unstable operation. FM deviation should be 5 MHz minimum.

e. Repeat step d at desired frequencies. FM deviation should be 5 MHz p-p minimum over most of the band.

f. Decrease oscillator output and observe FM deviation: FM deviation should decrease proportionally.

5-22. EXTERNAL SINE-WAVE SYNCHRONIZATION CHECK.

a. Connect Signal Generator in test setup shown in Figure 5-6.

b. Set Signal Generator controls as follows:

```

LINE ..... ON
MOD. SELECTOR ..... INT
POWER SET ..... 0
OUTPUT ATTEN ..... 0 dB
SYNC SELECTOR ..... ~

```

c. Adjust Oscillator for 40-Hz, 5 V rms input to Signal Generator.

d. Observe Oscilloscope for 40-Hz pulses.

e. Adjust Oscillator for 4000-Hz output; observe Oscilloscope for 4000-Hz pulses.

5-23. EXTERNAL PULSE SYNCHRONIZATION CHECK.

a. Connect Signal Generator in test setup shown in Figure 5-6, but replace Oscillator with Model 214B Pulse Generator.

b. Set Signal Generator controls as follows:

```

LINE ..... ON
MOD. SELECTOR ..... INT
POWER SET ..... 0
OUTPUT ATTEN ..... 0 dB
SYNC SELECTOR ..... EXT +

```

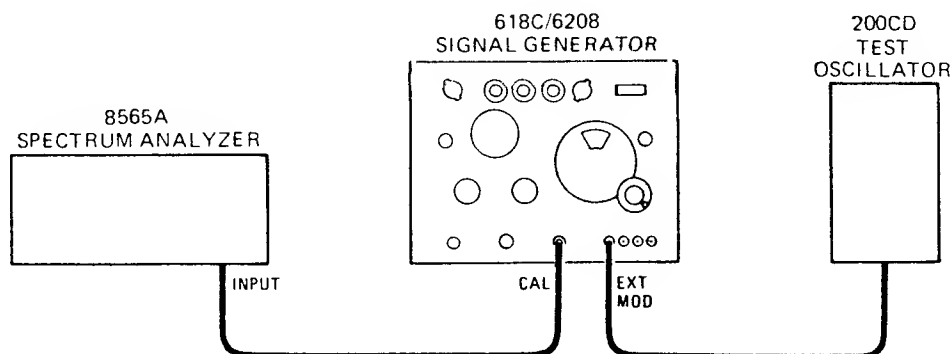


Figure 5-5. Setup for Testing Internal and External FM

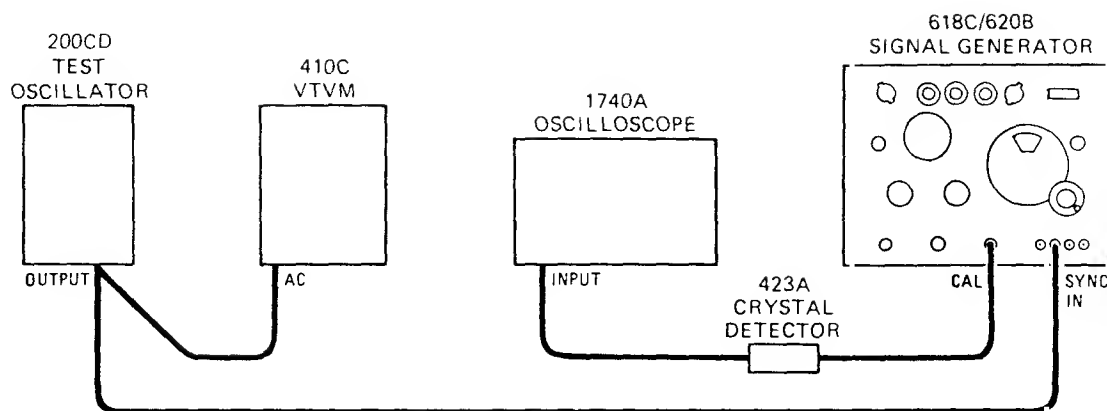


Figure 5-6. Setup for Testing External Sine-Wave Synchronization

c. Adjust Pulse Generator for 10-Hz, +5V peak output with a pulse width of 0.5 μ s.

d. Observe Oscilloscope for 10-Hz pulses.

e. Adjust Pulse Generator for +50V peak output; repeat step d.

f. Adjust Pulse Generator for 5- μ s pulse width; repeat step d.

g. Adjust Pulse Generator for 4000-Hz output.

h. Observe Oscilloscope for 4000-Hz pulses.

i. Adjust Pulse Generator for 5V output; repeat step h.

j. Adjust Pulse Generator for 0.5- μ s pulse width; repeat step h.

k. Set SYNC SELECTOR to EXT-.

m. Repeat steps c through j using negative pulses.

5-26A. 6.3 Vdc FILAMENT VOLTAGE ADJUSTMENT

WARNING

HIGH VOLTAGE. Measurement points used in this procedure (pins 22-25, 31, and 32) have 1000 volts potential to chassis. Use extreme care when making the filament voltage measurement. The use of a battery powered voltmeter with a plastic case (such as a Simpson 260) is recommended for this measurement. Do not use an ac powered instrument unless the common can be floated at 1000 Vdc and is isolated from the external chassis.

Adjust potentiometer R801 for 6.3 Vdc between pins 31 and 32 (note that pins 22, 23, and 31 are common; pins 24, 25 and 32 are common).

5-27. POWER-SUPPLY VOLTAGE ADJUSTMENTS.

5-28. There are two adjustable voltages: -700 (-1000V supply) and -500 (-1550 V supply) V. Adjust these voltages only if proven by accurate measurement to be outside the tolerances specified below. Adjust the output voltage of the -700 V regulator first and then adjust the -500 V regulator. After adjusting any regulator, check the output voltage of the other regulators to ensure they are within specified tolerances.

a. Connect an adjustable transformer to control Signal Generator line voltage.

b. Set Signal Generator controls as follows:

| | |
|------------------------|---------|
| LINE | ON |
| MOD. SELECTOR | CW |
| POWER SET | 0 |
| Frequency (618C) | 7.6 GHz |
| Frequency (620B) | 11 GHz |

5-24. ADJUSTMENTS.

5-25. TEST EQUIPMENT REQUIRED.

5-26. Test instruments required to perform the adjustments are listed in Table 5-2. Instruments other than those listed may be used provided their specifications equal or exceed the Critical Specifications.

Table 5-2. Test Equipment Required for Calibration and Troubleshooting

| Test Instrument | Critical Specifications | Recommended Model |
|-------------------------------------|---|-------------------------------|
| All instruments listed in Table 5-1 | | |
| Electronic Voltmeter | Range: 0 to 1550 volts Accuracy: $\pm 2\%$ | HP 410C |
| Clip-On DC Milliammeter | Range: 1 mA to 50 mA Accuracy: $\pm 3\%$ of full scale ± 0.1 mA | HP 428B |
| Frequency Meter | Frequency range: 3.8 to 7.6 GHz (618C) Accuracy: $\pm 0.1\%$ Frequency range: 7 to 11 GHz (620B) Accuracy: $\pm 0.1\%$ | HP 537A HP H532A and X532B |
| FM Modulator | Output voltage: 300V peak to peak and 6.3 Vac | See Figure 5-32 |
| Voltmeter | Insulated case able to safely float at 1000 Vdc common mode and measure 6.3 Vdc. | Simpson 260 |

- c. Adjust Transformer for 115 (or 230) V.
- d. Connect Electronic Voltmeter to test jack J6 (+) and ground (-).
- e. Adjust potentiometer R412 (Figure 5-7) for -1000 ± 20 volts. Line voltage regulation ($115\text{ V} \pm 10\%$) should hold the -1000 V supply to within $\pm 5\text{ V}$; ripple should be less than 10 mV , p-p. The -300 V supply could track the -1000 V supply to $-300 \pm 10\text{ V}$. Line voltage regulation ($115\text{ V} \pm 10\%$) should hold the -300 V supply to within $\pm 5\text{ V}$; ripple should be less than 10 mV , p-p.
- f. Connect Electronic Voltmeter to test jack J5 (+) and ground (-).
- g. Adjust potentiometer R512 (Figure 5-7) for $-1550 \pm 20\text{ V}$. Line voltage regulation ($115\text{ V} \pm 10\%$) should hold the -1550 V supply to within $\pm 5\text{ V}$; ripple should be less than 15 mV , p-p.

5-29. ADJUSTMENTS FOLLOWING REPLACEMENT OF KLYSTRON V114 (618C).

- 5-30. Following replacement of V114, it is important that certain adjustments be made as soon as the Signal Generator is turned on. The following procedure is recommended.
- a. With the signal generator removed from the cabinet and with MOD. SELECTOR on OFF, turn on signal generator.
 - b. Check the -300 , -700 , and -500 volt supplies (see paragraph 5-27).
 - c. With the MOD. SELECTOR set to CW, adjust R707 (Figure 5-8) for a klystron cathode current of 25 mA maximum (approximately 15 mA).

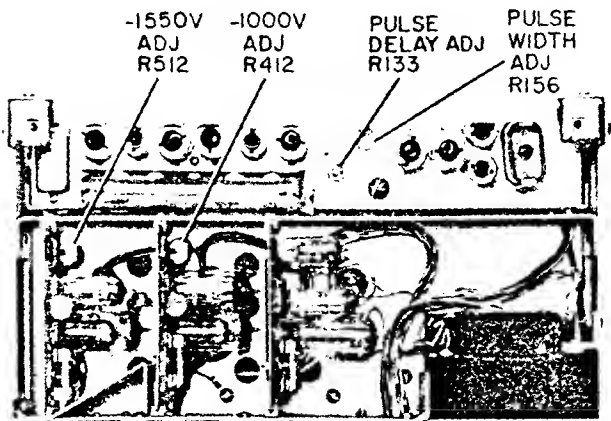


Figure 5-7. Location of Power Supply and Modulator Adjustments

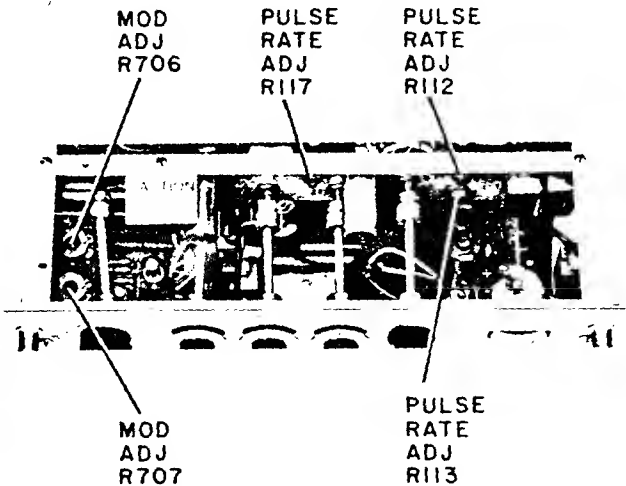


Figure 5-8. Location of Klystron and Modulator Adjustments (618C)

Note

A new klystron tube should now operate at least partially over the frequency range with original repeller voltage settings and for the most part, will require only 1/8 turn to bring the repeller voltage to optimum.

- d. Connect instrument as shown in Figure 5-9.
- e. Set MOD. SELECTOR to INT. (SYNC SELECTOR to X10). Tune frequency control to 7.6 GHz.
- f. Adjust R170 for optimum pulse shape.
- g. At this point it is advisable to check the dial calibration at the high end stop. This check avoids possible retracking adjustments when the dial calibration is adjusted later. To conduct the check, tune frequency control to high end stop and place wavemeter in circuit as shown in Figure 5-9. Wavemeter should indicate 7.650 GHz. When the wavemeter is tuned to the actual frequency of the generator a slight decrease in the peak level of the pulse appears on the scale. If this frequency is more than 25 MHz away from 7.650 GHz perform step d in paragraph 5-34.
- h. Remove wavemeter and reconnect output cable as shown in Figure 5-9. Tune the frequency control toward 5 GHz, adjusting R170 (Figure 5-11) for best pulse shape between 7.6 and 5 GHz.
- i. Tune the frequency control between 5 and 4.2 GHz; adjust R173 and/or R178 (Figure 5-11) for optimum pulse shape.
- j. Continue tracking the dial downward toward 3.8 GHz, adjusting R175 for optimum pulse.
- k. Tune the frequency control back toward 7.6 GHz observing the pulse shape on the oscilloscope. Re-adjust the appropriate reflector tracking potentiometer for optimum pulse shape.

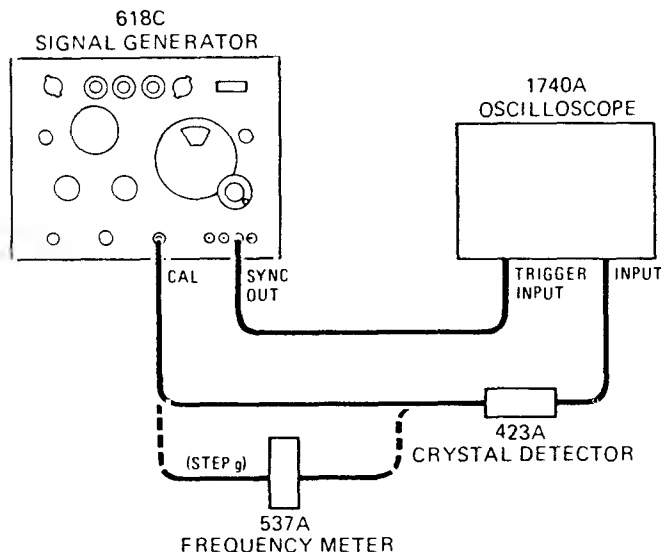


Figure 5-9. Setup for Frequency Dial Calibration (618C)

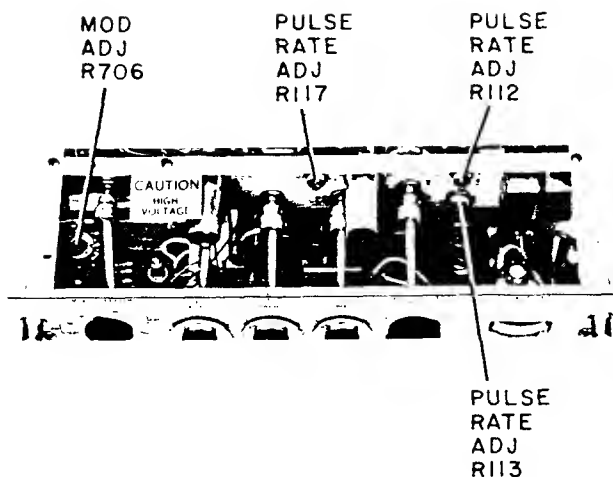


Figure 5-10. Location of Klystron and Modulator Adjustments (620B)

- m. If pulse misfiring or jitter occurs at any point in the band which cannot be corrected by adjustment of the reflector tracking potentiometers, adjust R706 for frequencies above the microswitch operation and R707 for frequencies below the microswitch operation.
- n. Set the MOD. SELECTOR to SQ. WAVE and observe the waveshape across the band. The waveshape may be improved by repeating the adjustment of R706 and R707 as outlined in step m preceding.
- p. Check frequency dial calibration as described in paragraph 5-33.

5-31. ADJUSTMENTS FOLLOWING REPLACEMENT OF KLYSTRON V114 (620B).

5-32. Following replacement of V114, it is important that certain adjustments be made as soon as the signal generator is turned on. The following procedure is recommended.

- a. With Signal Generator removed from cabinet set MOD. SELECTOR to OFF and turn on instrument.
- b. Check -300, -700 and -500 V supplies, and klystron cutoff bias. Refer to paragraph 5-27 for power supply adjustments.
- c. Adjust frequency control to 10 GHz.
- d. Set MOD. SELECTOR to CW and measure klystron beam current with 428B Clip-on DC Milliammeter. Adjust potentiometer R706 (Figure 5-10) for 22-mA klystron beam current.
- e. Adjust POWER SET control to obtain up-scale indication on the power set meter. If necessary, adjust potentiometer R170 (Figure 5-11) to obtain proper meter indication. Recheck klystron beam current (25 mA maximum).
- f. Adjust Signal Generator to a frequency just above the point where the microswitch is actuated (approximately 8.8 GHz).

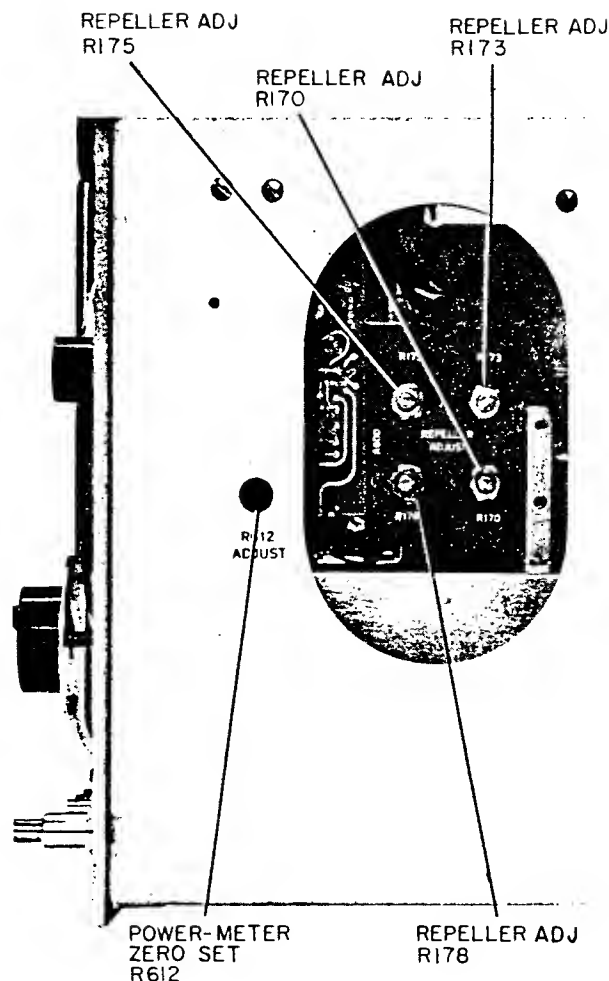


Figure 5-11. Location of Tracking and Power-Set Meter Adjustments

g. Connect Signal Generator in test setup shown in Figure 5-12.

h. Set MOD. SELECTOR to EXT FM and observe repeller mode pattern on Oscilloscope. Adjust OUTPUT ATTEN and external modulating voltage to obtain the desired vertical deflection on Oscilloscope. Adjust FM AMPLITUDE control to obtain humped waveform shown in Figure 5-12. If necessary adjust the phase of repeller mode pattern.

i. Adjust Signal Generator across entire band while observing the repeller mode pattern on Oscilloscope. If the RF power level drops abruptly (in general, between 8.4 and 8.7 GHz), proceed as follows:

- (1) Turn off Instrument.
- (2) Loosen klystron mounting nut.
- (3) Rotate klystron slightly and make sure klystron is seated properly against shoulder in collet.

- (4) Tighten klystron mounting nut by hand.
- (5) Check to be sure that the repeller cable is not twisted and makes firm connection to repeller.
- (6) Turn on Instrument and observe repeller mode patterns on oscilloscope.

Repeat steps (1) through (6) preceding, rotating klystron slightly each time until the optimum repeller mode pattern is obtained across entire band.

j. Turn off Instrument. Set frequency dial at high-frequency stop and tighten klystron mounting nut.

k. Install tube socket housing with cable entrance towards rear of instrument. Replace four screws.

m. Turn on Signal Generator.

n. Measure Signal Generator output frequency with Frequency Meter. If the measured frequency is below 11.1 GHz, remove bottom plate from frequency drive mechanism and perform (1) through (4) following; if not, perform (5) through (9) following:

- (1) Loosen plunger cap screw (Figure 5-13).
- (2) Adjust Frequency Meter to 11.1 GHz.
- (3) Gently tap rear of plunger until Frequency Meter dip is centered on mode pattern.
- (4) Tighten plunger cap screw and replace bottom plate.
- (5) Set Frequency Meter to 11.1 GHz.
- (6) Adjust frequency dial until Frequency Meter pattern is centered on the mode pattern.
- (7) Loosen plunger cap screw.
- (8) Turn frequency dial to high frequency stop while holding plunger stationary.
- (9) Tighten plunger cap screw and replace bottom plate.

p. Tune Signal Generator across entire band and center repeller mode pattern with repeller tracking potentiometer R170, R173, R175, and R178 (Figure 5-9). Figure 5-12 (A and C) shows two typical mode patterns. Figure 5-12A shows a symmetrical mode pattern that is properly centered by the correct repeller voltage; Figure 5-12B shows the same pattern set off-center by incorrect setting of repeller voltage. Adjust potentiometer R170 and R178 (Figure 5-11) to obtain correct repeller voltage tracking between 11 GHz and the frequency just above the point where the microswitch is actuated (approximately 8.7 to 9 GHz). Adjust potentiometers R173 and R175 (Figure 5-11) to obtain correct repeller voltage tracking between the frequency just below the point where the microswitch is actuated (approximately 8.6 GHz) and 7 GHz.

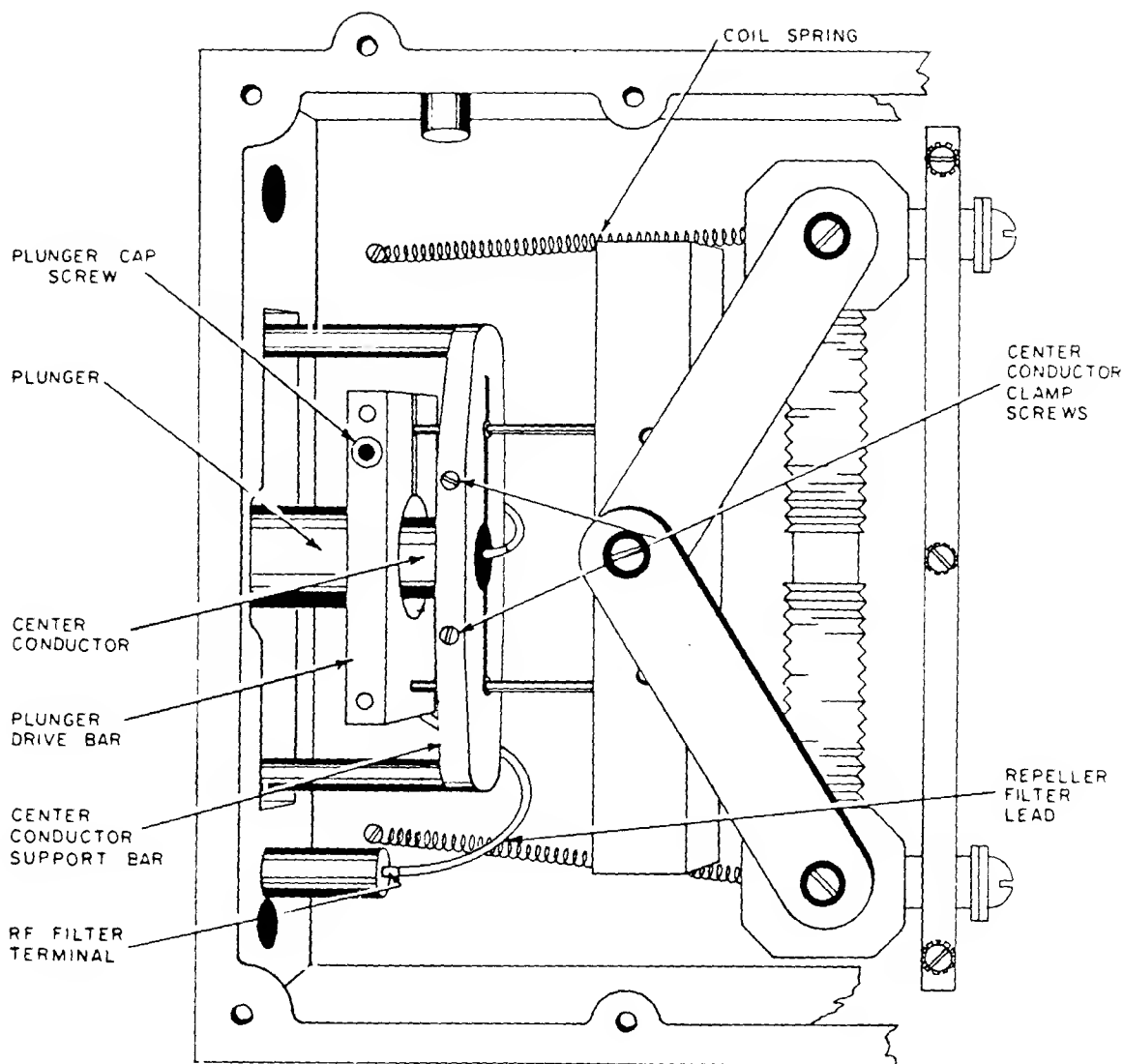


Figure 5-13. Frequency Drive Mechanism, Cover Plate Removed (620B)

5-35. CALIBRATING THE FREQUENCY DIAL (620B).

5-36. Replacing the klystron will usually reduce the accuracy of the frequency dial by several percent from its rated accuracy of 1%. If accuracy of frequency dial calibration is important, the following procedure can be used to restore accuracy. In general, when a new klystron oscillator tube is installed it is necessary to slip the frequency dial slightly to bring it into calibration. In some cases, it may also be necessary to re-set the plunger depth to re-establish the correct high-frequency limit. All adjustments for frequency recalibration must be done mechanically. To recalibrate the frequency dial following a klystron change proceed as follows:

a. Following initial voltage adjustments (paragraph 5-32), set MOD. SELECTOR to CW and allow Signal Generator to warm up for 20 minutes.

b. Assuming that the repeller adjustments have been set for best operation of the new klystron, tune

Signal Generator to the highest frequency at which the klystron will oscillate; measure this frequency with a Frequency Meter.

c. If the klystron cannot be made to oscillate up to 11 GHz, refer to the troubleshooting procedures.

d. If the klystron oscillates satisfactorily up to 11.1 GHz, check the frequency-dial calibration accuracy over the full frequency range. If the dial calibration is too high or too low over the entire range by a nearly equal amount, the frequency dial may be slipped into calibration by removing the frequency dial cover, loosening the dial hub, and turning the dial a small amount.

e. If slipping the dial will not bring both the high and low ends of the frequency dial into calibration, the high end can first be correctly set by altering the depth of the cavity plunger slightly to obtain the correct upper frequency limit and then slip the dial to bring the low frequency end into calibration.

f. To set the high-frequency limit of the klystron by shifting the plunger setting, remove the bottom plate of the frequency-drive casting to expose the plunger mechanism.

g. Adjust the signal generator to produce 11 GHz as read on the Frequency Meter.

h. Refer to Figure 5-13 and loosen the cap screw holding the plunger in the plunger-drive bar.

i. Holding the plunger in the 11 GHz position, adjust the frequency drive for a reading of 11 GHz on the dial. Tighten cap screw.

j. If oscillation stops when the plunger is moved, readjust the appropriate repeller voltage potentiometer to regain oscillation.

k. Recheck low end of frequency range noting frequency dial accuracy. If dial is inaccurate, remove dial cover, loosen hub slightly and slip frequency dial to correct indication.

m. Recheck accuracy of frequency dial at main points across the band. Refine the foregoing adjustments to produce the best overall accuracy.

n. If the frequency spread of a new klystron tube is much greater or less than that of the original tube, it may not be possible to use the original dial for the new tube. In this case, another klystron must be tried and a new frequency dial must be calibrated.

5-37. CALIBRATING THE PULSE RATE CONTROL.

5-38. Replacing Tube V103 or associated components may lessen the accuracy of the PULSE RATE control but will not otherwise affect the performance of the Signal Generator. It should be noted, however, that the calibration of this dial is only approximate. To calibrate the PULSE RATE dial, proceed as follows:

a. Set Signal Generator controls as follows:

MOD. SELECTOR INT.
PULSE WIDTH max cw
PULSE DELAY max ccw
PULSE RATE max ccw
SYNC SELECTOR X10

b. Connect Microwave Frequency Counter to SYNC OUT connector.

c. Adjust potentiometer R112 (Figure 5-8) so that the counter indicates 4800 Hz.

d. Set SYNC SELECTOR to X1.

e. Adjust potentiometer R113 (Figure 5-8) so that counter indicates 480 Hz.

f. Set PULSE RATE fully ccw.

g. Adjust potentiometer R117 (Figure 5-8) so that counter indicates 30 Hz.

h. Adjust PULSE RATE control for a counter reading of 200 Hz.

i. Loosen PULSE RATE dial and adjust to a reading of 200.

5-39. CALIBRATING THE PULSE DELAY CONTROL.

5-40. Replacing tube V107 may degrade the accuracy of the PULSE DELAY Control. After replacing V107, the following procedure can be used to adjust the delay calibration. It should be noted, however, that the calibration of the PULSE DELAY dial is intended only to be approximate.

a. Connect the DELAY SYNC OUT terminal to an oscilloscope vertical input.

b. Synchronize the Oscilloscope with signal at SYNC OUT connector.

c. Set PULSE DELAY control to 300 μ s.

d. Adjust potentiometer R133 (Figure 5-7) to give a delay of 300 μ s as measured on the calibrated Oscilloscope.

e. Set PULSE DELAY control to 50 μ s as indicated by Oscilloscope. (The delay is indicated by the interval between the start of the Oscilloscope trace and the leading edge of the delayed sync pulse.) If necessary, slip the PULSE DELAY dial on its shaft to make calibration accurate.

5-41. CALIBRATING THE PULSE WIDTH CONTROL.

5-42. Replacing Tube V111 may lessen the accuracy of the PULSE WIDTH Control. This control is intended to be accurate within 20% or 1 μ s, whichever is greater. To calibrate the PULSE WIDTH control, proceed as follows:

a. Connect RF OUTPUTS UNCAL through a Crystal Detector to vertical input of an Oscilloscope.

b. Synchronize Oscilloscope with signal at the SYNC OUT connector.

c. Set PULSE WIDTH control to 10 μ s.

d. Adjust potentiometer R156 (Figure 5-7) so that width of pulse of 10 μ s as measured on the Oscilloscope.

e. Set the PULSE WIDTH control to 2- μ s pulse width on Oscilloscope.

f. If necessary, slip dial to read 2 microseconds.

g. Repeat steps c through f for best overall calibration accuracy.

Note

The width of RF pulse will vary approximately 0.25 μ s as the generator is tuned through its RF range. The above adjustments can be made for best accuracy at any desired RF frequency.

5-43. POWER SET METER ADJUSTMENTS.

5-44. MECHANICAL ZERO. Adjust mechanical zero as follows:

- a. Remove instrument cover for access to the meter. Lift the white paper sticker that covers the zero adjust. Be sure to replace it when through.
- b. Connect shorting lead across meter terminals.
- c. With a non-metallic tool, adjust mechanical zero-adjust screw until meter pointer is at left of meter dot and moving towards meter dot; stop adjustment when meter pointer is exactly at dot.
- d. Carefully adjust mechanical zero-adjust screw a few degrees to free screw from meter suspension. If pointer moves off dot, repeat step c.
- e. Remove shorting lead from meter terminals and replace instrument cover.

5-45. ELECTRICAL ZERO. The electrical zero is set at the factory and requires adjustment only when bolometer circuit components are changed. Adjust as follows:

- a. Remove instrument cover for access to R612 (see Figure 5-11).
- b. Set MOD. SELECTOR to CW.
- c. Adjust POWER SET until meter pointer is about 3/8 inch to the right of zero (0).
- d. Set MOD. SELECTOR to OFF.
- e. Adjust zero set control (R612) until meter pointer is at the dot at the left end of the scale. Replace the instrument cover.

5-46. TROUBLESHOOTING.**5-47. TEST EQUIPMENT REQUIRED.**

5-48. The test equipment required to troubleshoot the Signal Generator is listed in Table 5-2. Instruments other than those listed may be used provided their specifications equal or exceed the critical specifications.

5-49. ISOLATING A TROUBLE TO A CIRCUIT SECTION.

5-50. The troubleshooting procedures are designed to identify the causes of one or more of the following symptoms:

- a. Low or no RF output at RF OUTPUTS CAL.
- b. RF output normal but abnormal indication on front-panel power meter.
- c. No or low amplitude-modulation level.
- d. No or little frequency modulation.
- e. Modulation frequency, width, or delay abnormal.
- f. Poor or no external synchronization.

5-51. Each of the above troubles first requires isolation to a faulty functional section of the Signal Generator. Regardless of the trouble encountered, the power supply voltages should first be checked (see paragraph 5-27). If a power supply is within 4 or 5% of its nominal value, it should not cause any catastrophic trouble. However, a greater deviation from nominal could be suspected as the cause of a near complete failure of a Signal Generator function. If a voltage value exceeds 4% of its nominal level, the power supply should be repaired prior to troubleshooting the other circuits of the instrument.

5-52. POWER SUPPLY TROUBLESHOOTING. Because the individual power supplies are to some extent interdependent, care must be taken to troubleshoot the supplies in a particular sequence. This sequence is as follows: -300 V supply, -700 V supply, -500 V supply, and the 6.3 V filament supplies.

WARNING

Use extreme care when making the filament voltage measurements. One side of each ac supply is connected to a negative high-voltage source. The use of a battery powered voltmeter with a plastic case (such as a Simpson 260) is recommended for this measurement. Do not use an ac powered instrument unless the common can be floated at 1000 Vdc and is isolated from the external chassis.

5-53. To isolate a trouble in the -300 V supply, check the -300 V output at test point 2. Excessive ripple is probably due to a failure of capacitor, C360, C361, C362, or C363, or a heater-cathode short in V301-V304. If the -300 V output is nonexistent or very low, check the dc voltage between test points 2 and 13 to establish that the dc input to the regulator is normal. If normal, the regulator circuit composed of V301-V304 and associated parts is faulty. Isolate the faulty tube or part through voltage and resistance checks (Figures 5-21, 5-22), and tube replacement. It should be noted that the regulator circuit comprises a servo (feedback) loop, and hence a failure of any part will be reflected by erroneous voltage indications at most points in the circuit. Resistance readings, however, usually provide an indication of a faulty part.

5-54. It should be established that an excessive load is not being placed on the power supplies, such as a shorted high-voltage decoupling capacitor or shorted tube. Excessive load conditions gives trouble symptoms similar to those encountered in a power supply failure. A Model 428B Ammeter can be used to check the current load on the supplies. Table 5-3 lists the check points for each supply.

5-55. If the dc voltage input to the regulator circuit is abnormal, check the ac voltage between test points 3 and 4 (see WARNING in paragraph 5-52). If this voltage is normal, voltage-doubler diodes CR301, CR302, or associated filter parts (C360-C362, R361, R362) are faulty. If the ac voltage across test points 3 and 4 is abnormal, transformer T1 or the 115 (or 230) V primary-power circuit is faulty.

Table 5-3. Power-Supply Current Measurements

| Test Point* | Current (mA) |
|------------------------------|---------------|
| Pink lead connected to TB1-5 | 7 \pm 1 |
| Red lead connected to TB1-6 | 2.3 \pm 0.5 |
| Red lead connected to TB1-7 | 4.3 \pm 0.5 |

*MOD. SELECTOR set to INT PULSE; frequency adjusted to 7.6 GHz (618C); 11 GHz (620B).

Note

The -700 V and -500 V supplies are checked in a manner similar to the -300 V supply, using the particular test points assigned to these supplies. Care must be taken to follow the sequence given in paragraph 5-52.

5-56. **NO OR LOW RF OUTPUT.** Assuming the power supply to be normal, no or very low RF output could be caused by a faulty RF attenuator probe, or a faulty klystron and associated components. A faulty attenuator probe can be positively identified by adjusting the POWER SET control to obtain a normal indication on the front panel power meter. If the meter indication is normal, the RF attenuator probe is faulty; otherwise the problem is in the klystron or associated circuit parts. The klystron oscillator is best checked by voltage and current measurements. Refer to Figure 5-22 or klystron voltage measurements and paragraphs 5-30 and 5-32 for measurement of klystron beam current. If all measurements are normal, replace the klystron. Abnormal voltage measurements indicate a failure of one or more circuit parts. If an abnormal indication occurs in the klystron repeller circuit, perform resistance measurements to isolate the faulty part. In the klystron grid circuit, perform resistance checks and check modulator tube V701. In the cathode circuit, check diodes CR701 and CR702.

5-57. **RF OUTPUT NORMAL BUT RF OUTPUT METER ABNORMAL.** This trouble indication is caused by either a faulty power-monitor probe or power meter circuit. A faulty power-monitor probe is detected by removing diode CR603 and measuring the resistance between center conductor and case. Normal indication is 50 \pm 5 ohms. If both the probe and detector check normal, perform voltage checks (see Figure 5-22) on transistors Q601 through Q603 to isolate the faulty part in the power meter circuit.

5-58. **NO OR LOW AMPLITUDE MODULATION.** To identify this type of trouble first establish that the trouble is with all amplitude-modulation modes (internal pulse, external pulse, or internal square wave) or only one of the modes. If all amplitude modulation modes are faulty, Modulator tube V701 or associated circuit parts are probably faulty. This can be checked by performing waveform measurements at test points 14 and 15 (see Figure 5-27). If the abnormal indication is at test point 14 only, check V701 and the plate circuit components. If both test points are abnormal, check V701 and the grid circuit components. Voltage and resistance checks should isolate a faulty part.

5-59. If the trouble involves only internal pulse modulation, the trouble is in MOD. SELECTOR switch S102 or the internal pulse-generating circuits. To isolate the trouble, check the waveforms (Figure 5-27) at test points 22 through 16, (in that order) and refer to the following list of troubles when an abnormal waveform is encountered.

| Abnormal Waveform at Test Point | Trouble |
|---------------------------------|--|
| 22 | V102, V103, or associated parts |
| 21 | V105 or associated parts |
| 20 | S102, deck H; or V106, V107, or associated parts |
| 19 | S102, deck F; or V109 or associated parts |
| 18 | V108 or associated parts |
| 17 | V111 or associated parts |
| 16 | S102, deck E |

5-60. If only external pulse modulation is faulty, set MOD. SELECTOR to -EXT and check modulation. If normal, inverter V109A is faulty. If abnormal, switch S102 (sections E or G) is faulty, or capacitor C123 or resistor R143 is faulty. The latter two components may be isolated by checking the external modulating signal at test point 23.

5-61. If only square-wave modulation is faulty, perform waveform measurements at test point 22. If normal, switch S102 (deck G) is faulty. If abnormal, V102, V103, or associated parts are faulty.

5-62. **NO OR LITTLE FREQUENCY MODULATION.** First establish if the trouble is with both external and internal FM. If the trouble is isolated to external FM only, check waveform (Figure 5-27) at test point 23. If waveform at test point 23 is normal, the trouble is in MOD. SELECTOR switch S102, section B or G. If waveform at test point 23 is abnormal, check capacitor C123 and resistor R143. If trouble is with both external and internal FM, perform waveform measurement at test point 24. If waveform at test point 24 is abnormal check capacitor C136 and variable resistor R168. If waveform at test point 24 is normal, perform voltage and resistance measurements (Figures 5-21, 5-22 of the klystron repeller circuit.

5-63. If only internal FM is faulty, place MOD. SELECTOR to INT FM, check waveform (Figure 5-25) at test points 18 and 21. If indication at both test points is normal, perform voltage and resistance measurements (Figures 5-21, 5-22) on V108B, V110, S102 (section B and D) and coupling capacitor C135. If indication at test point 18 is abnormal, check S102, section F. If indication at test point 21 is abnormal, perform voltage and resistance checks (Figures 5-21, 5-22) of V105 and associated circuit parts.

5-64. **MODULATION FREQUENCY, WIDTH, OR DELAY ABNORMAL.** A trouble involving the frequency of internal modulation is caused by Multivibrator V102, V103 and associated parts. Pulse width troubles are caused by a fault in Multivibrator V111 or associated parts. Pulse delay troubles are caused by a fault in Multivibrator V106, V107 or associated parts.

5-65. **POOR EXTERNAL SYNCHRONIZATION.** A trouble involving the external synchronization is caused by Amplifier and Inverter V101 and associated parts. To isolate a trouble in the external synchronization to a faulty part, perform voltage and resistance measurements (Figures 5-21, 5-22) of V101 and associated circuit.

5-66. ISOLATING TROUBLE IN TRANSISTOR CIRCUITS.

5-67. The following procedures and data are given to aid in determining whether a transistor is operational. Tests are given for both in-circuit and out-of-circuit transistors.

5-68. IN-CIRCUIT TESTING.

5-69. The common causes of transistor failures are internal short- and open-circuits. In transistor circuit testing the most important consideration is the transistor base-emitter junction. Like the control grid of a vacuum tube, this is the operational control point in the transistor. This junction is essentially a solid-state diode. For the transistor to conduct, the diode must conduct; that is, the diode must be forward biased. As with simple diodes, the forward-bias polarity is determined by the materials forming the junction. Use the transistor symbol on the schematic diagram to determine the bias polarity required to forward-bias the base-emitter junction. The A part of Figure 5-14 shows transistor symbols with terminals labeled. Notice that the emitter arrow conventionally points toward the type N material. The other two columns of the illustration compare the biasing required to cause conduction and cut-off in transistors and vacuum tubes. If the transistor base-emitter diode (junction) is forward-biased the transistor conducts. If the diode is heavily forward-biased, the transistor saturates. However, if the base-emitter diode is reverse-biased the transistor is cut-off. The voltage drop across a forward biased emitter-base diode varies with transistor collector current. For example, a germanium transistor has a typical forward-bias, base-emitter voltage of 0.2-0.3 V when collector current is 1-10 mA, and 0.4-0.5 V when collector current is 10-100 mA. In contrast, forward bias voltage for silicon transistors is about twice that for germanium types: about 0.5-0.6 V when collector current is low, and about 0.8-0.9 V when collector current is high.

5-70. Figure 5-14, part B, shows simplified versions of the three basic transistor circuits and gives the operating characteristics of each. When examining a transistor stage, first determine if the emitter-base diode is biased for conduction (forward-biased) by measuring the voltage difference between emitter and base. When using an electronic voltmeter, do not measure directly between emitter and base; there may

be sufficient loop current between the voltmeter leads to damage the transistor. Instead, measure to a common point (e.g., chassis). If the emitter-base diode is forward-biased, check for amplifier action by short-circuiting base to emitter while observing collector voltage. The short-circuit eliminates base-emitter bias and should cause the transistor to stop conducting (cut off). Collector voltage should then shift to near the supply voltage. Any difference is due to leakage current through the transistor and, in general, the smaller this current, the better the transistor. If collector voltage does not change, the transistor may have an internal open or short.

5-71. TESTING TRANSISTORS WITH AN OHMMETER.

5-72. The two common causes of transistor failure are internal short- and open-circuits. Remove the transistor from the circuit (caution with heat) and use an ohmmeter to measure internal resistance. See Table 5-4, for measurement data.

CAUTION

Most ohmmeters can supply enough current or voltage to damage a transistor. Before using an ohmmeter to measure transistor forward or reverse resistance, check open-circuit voltage and short-circuit current output ON THE RANGE TO BE USED. Open-circuit voltage must not exceed 1.5 V and short-circuit current must be less than 3 mA. See Table 5-5 for safe resistance ranges for some common ohmmeters.

5-73. KLYSTRON REMOVAL (618C).

5-74. To remove the klystron oscillator tube V114 from the resonant cavity proceed as follows:

- a. Remove the socket housing cap, screws and lock washers (items 1 and 2, Figure 5-15). Pull the housing (3) away until the tube socket is exposed.

- b. Pull straight back on the socket until it is free of the tube base. Do not apply lateral pressure when removing socket.

- c. Unscrew and remove sleeve (4) which covers klystron body. Do not at any time apply side motion to the klystron; to do so will break the tube.

- d. Turn klystron (6) clockwise, and at the same time pull straight back from the cavity. Do not attempt to rock the klystron.

- e. Remove rubber washer (14) and clamping ring (5).

- f. Unscrew retaining nut (7) at cavity entrance using socket wrench supplied with the instrument. Remove the seating ring (9) and the spring (8) below retaining nut. Do not use this spring or washer again except as a necessity. New springs and washers are supplied with replacement klystrons ordered from Hewlett-Packard Co.

A. TRANSISTOR BIASING

| DEVICE | SYMBOL | CUT OFF | CONDUCTING |
|------------------|--------|---------|------------|
| VACUUM TUBE | | | |
| N P N TRANSISTOR | | | |
| P N P TRANSISTOR | | | |

B. AMPLIFIER CHARACTERISTICS

| CHARACTERISTIC | COMMON BASE | COMMON EMITTER | COMMON COLLECTOR |
|----------------|-------------------|-------------------|------------------|
| INPUT Z | 30-50 Ω | 500-1500 Ω | 20-500K Ω |
| OUTPUT Z | 300-500K Ω | 30-50K Ω | 50-1000 Ω |
| VOLTAGE GAIN | 500-1500 | 300-1000 | < 1 |
| CURRENT GAIN | < 1 | 25-50 | 25-50 |
| POWER GAIN | 20-30 dB | 25-40 dB | 10-20 dB |
| | | | |

Figure 5-14. Transistor Biasing and Operating Characteristics

Table 5-4. Out-of-Circuit Transistor Resistance Measurement

| Transistor Type | | Connect Ohmmeter | | Measure Resistance (ohms) |
|-----------------|--------------|------------------|--------------|-----------------------------|
| | | Pos. lead to | Neg. lead to | |
| PNP Germanium | Small Signal | emitter | base* | 200-500 |
| | | emitter | collector | 10K-100K |
| | Power | emitter | base* | 30-50 |
| | | emitter | collector | several hundred |
| NPN Silicon | Small Signal | base | emitter | 1K-3K |
| | | collector | emitter | very high (might read open) |
| | Power | base | emitter | 200-1000 |
| | | collector | emitter | high, often greater than 1M |

*To test for transistor action, add collector-base short. Measured resistance should decrease.

Table 5-5. Safe Ohmmeter Ranges for Transistor Resistance Measurements

| Ohmmeter | Safe Range(s) | Open Ckt Voltage | Short Ckt Current | Lead | |
|-------------|---------------|------------------|-------------------|---------------------------|----------|
| | | | | Color | Polarity |
| HP 412A | R x 1K | 1.0V | 1 mA | Red | + |
| | R x 10K | 1.0V | 100 μ A | Black | - |
| | R x 100K | 1.0V | 10 μ A | | |
| | R x 1M | 1.0V | 1 μ A | | |
| | R x 10M | 1.0V | 0.1 μ A | | |
| HP 410C | R x 1K | 1.3V | 0.57 mA | Red | + |
| | R x 10K | 1.3V | 57 μ A | Black | - |
| | R x 100K | 1.3V | 5.7 μ A | | |
| | R x 1M | 1.3V | 0.5 μ A | | |
| | R x 10M | 1.3V | 0.05 μ A | | |
| HP 410B | R x 100 | 1.1V | 1.1 mA | Black | + |
| | R x 1K | 1.1V | 110 μ A | Red | - |
| | R x 10K | 1.1V | 11 μ A | | |
| | R x 100K | 1.1V | 1.1 μ A | | |
| | R x 1M | 1.1V | 0.11 μ A | | |
| Simpson 250 | R x 100 | 1.5V | 1 mA | Red | + |
| | | | | Black | - |
| Simpson 259 | R x 1K | 1.5V | 0.82 mA | Black | + |
| | | | | Red | - |
| Triplet 630 | R x 100 | 1.5V | 3.25 mA | Varies With Serial Number | |
| | R x 1K | 1.5V | 325 μ A | | |
| Triplet 310 | R x 10 | 1.5V | 750 μ A | | |
| | R x 100 | 1.5V | 75 μ A | | |

g. If sample probe adapter (11) protrudes into the cavity, remove the lock nut (12) and disengage pipe (10). Loosen lock nut (12) and back out adapter (11) until it is flush with the inside face of the cavity bottom plate.

Note

See Klystron Tube Warranty Claim in this manual.

5-75. KLYSTRON REPLACEMENT (618C).

5-76. Prior to installing a new klystron V114, practice reinstalling the old one. The proper force and twist required to push the klystron past the spring may then be learned by practice. The procedure for installing the new klystron is as follows:

a. Install new waffle seating ring (9, Figure 5-15) and then new spring (8) in cavity entrance. Ends of spring should meet to form a complete circle.

b. Thread the retaining nut (7) into cavity until it is seated very lightly against the spring. Press spring into place under the nut so that it forms a circle. Tighten the nut slightly to hold the spring in position.

CAUTION

When inserting the tube, always keep it straight in line with the cavity. DO NOT work it from side to side.

c. Insert the klystron tube (6) into the cavity until it engages the spring (8). Firmly press the tube straight into the cavity at the same time giving it a clockwise twist. The twist will cause the spring to expand and pass the tube allowing it to seat firmly in the cavity.

d. Tighten the retaining nut slightly with socket wrench supplied.

e. Snap the clamping rings (5) making certain that they encircle the grid ring of the klystron. When the rings are in position, three or four threads of the nut (7) should be visible between the clamping rings and the outside face of the nut. Install rubber washer (14).

f. Thread the cover sleeve (4) into the retaining nut so that it seats against the clamping rings, causing the clamping ring to grip the grid ring of the klystron. Tighten the sleeve firmly by hand.

g. Install the tube socket and housing (3), pressing the socket straight into position.

h. Position socket housing and attach cap screws (1).

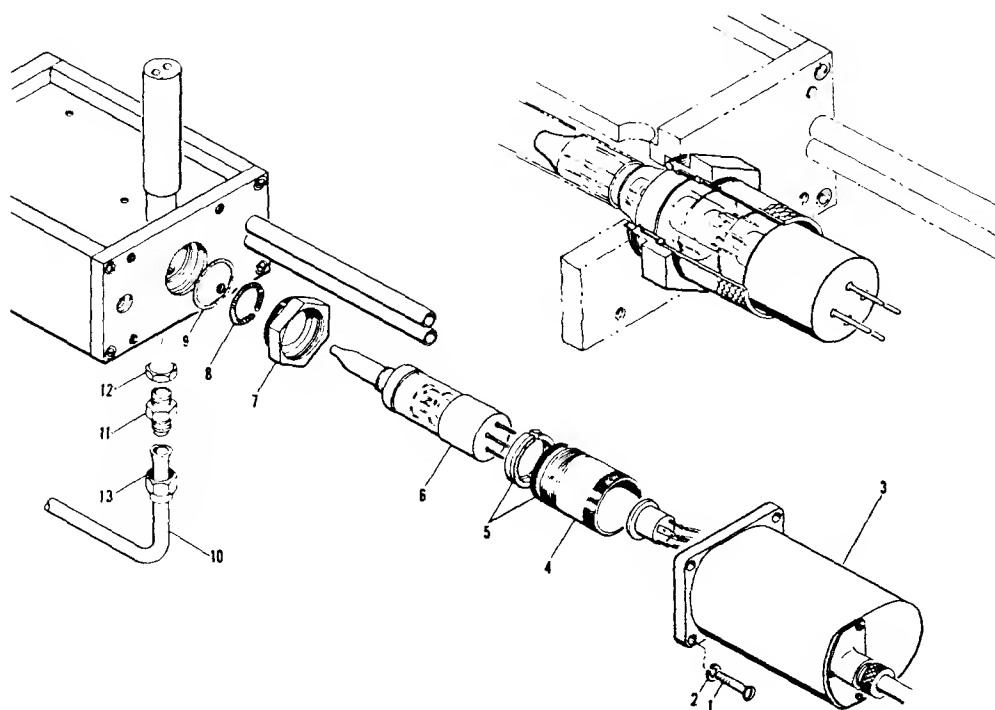


Figure 5-15. Exploded View of Klystron Mounting Parts (618C)

5-77. KLYSTRON REMOVAL (620B).

5-78. To remove the klystron from the resonant cavity, remove the Instrument from the cabinet or rack.

The klystron is located at the left side of the instrument just behind the front panel. Refer to Figure 5-16 and proceed as follows:

CAUTION

Do not at any time apply side pressure to the klystron. To do so will break the tube.

- Remove the four screws from the klystron tube base cover.
- Pull tube base cover straight out to expose tube base.
- Remove socket from klystron. Pull socket straight out to expose tube base.
- Loosen and remove klystron mounting nut with wrench supplied.
- Remove collet washer with a sharp tool. Grasp klystron tube base and pull straight out of cavity.
- Remove clamp spring.
- If collet ring and collet are locked on klystron, place klystron on its base and gently tap collet ring to free the collet.

Note

See Klystron Tube Warranty Claim at rear of Replaceable Parts.

5-79. KLYSTRON REPLACEMENT (620B).

- Insert waffle washer in cavity (Figure 5-16). Use new washer if old washer is damaged.
- Place collet ring and collet spring on collet, making sure taper on ring seats against flare of collet.
- Place collet washer over collet. Place mounting nut over collet washer.
- Place klystron assembly into cavity and tighten mounting nut by hand until collet just grips klystron, but klystron should still be free to rotate.
- Slide klystron out approximately 1/8 inch, then push in until klystron seats firmly against shoulder in collet.

CAUTION

DO NOT USE EXCESSIVE PRESSURE, to prevent possible damage to klystron.

- Tighten mounting nut by hand, then push socket on klystron base, being careful not to exert any side pressure on the klystron.
- Remove cover plate from frequency drive mechanism to check repeller cable. Be sure to push the repeller cable into center conductor to connect the repeller before turning on the instrument.

h. With an ohmmeter connected between the orange and blue leads on the potentiometer, turn the frequency control to point where microswitch just operates (approximately 8.9 GHz), so the arm (blue lead) is exactly the tap in the potentiometer. This point is the lowest resistance reading on ohmmeter.

i. Replace rear potentiometer cover and reconnect leads.

j. Tighten set screws in the coupler.

k. Reset repeller voltage adjustments as described in paragraphs 5-33 and 5-35.

5-82. REPLACING AND RECALIBRATING THE ATTENUATOR (618C).

5-83. It is not expected that the attenuator dial will require recalibration unless the attenuator assembly is replaced. The attenuator is not ordinarily subject to change or breakage. Small improvements in accuracy may be made by slipping the attenuator dial on the front panel slightly on its shaft to bring into calibration.

5-84. Following replacement of the probe, the attenuator assembly must be adjusted for the correct and safe operating depth. The following instructions are divided into two parts: the first concerns the replacement of the attenuator probe, and the second concerns the attenuator dial alignment.

5-85. REPLACING THE ATTENUATOR PROBE (618C).

5-86. Power from the resonator is coupled to the RF OUTPUTS CAL jack at the front panel through an assembly consisting of the panel jack, a length of RG-55 U cable, and the attenuator probe. The attenuator probe is terminated by a special resistor, which is made by coating platinum on a glass bead. This resistor should normally last for the life of the equipment even if subject to shock and vibration. Should the resistor become broken or otherwise defective however, the complete attenuator assembly must be replaced. Replace a defective attenuator assembly as follows:

a. Remove the four screws holding the RF OUTPUTS CAL connector to the front panel.

b. Release attenuator cable from under cable clamp.

c. Remove mounting screw which holds the rack to the aluminum block on the attenuator probe.

d. Lift mounting block and probe from the circular waveguide housing.

e. Use care in handling attenuator probes. The glass bead resistor can be broken by twisting the cable. Mounting block comes affixed to new probe.

f. Insert new probe into waveguide only as far as is necessary to match-up block mounting holes. Insert mounting screw and tighten. Take care that the probe ground is oriented in the right direction (away

from the cavity). The glass beads should be visible on the **RIGHT HAND SIDE** of the ground connection extension when viewing the instrument from the front.

g. Carefully thread cable under cable clamp and around casting to front panel. Avoid twisting cable more than one-quarter turn.

h. Remount RF OUTPUTS CAL connector. Tighten cable clamp.

i. After the assembly is replaced, an error of a few decibels may exist in the calibration of the attenuator dial.

5-87. RECALIBRATING THE ATTENUATOR (618C).

a. Connect signal generator in test setup shown in Figure 5-1.

b. Turn signal generator on and allow a 20-minute warm up period with modulation selector switch in CW position.

c. Turn modulation selector switch to OFF position, adjust zero set controls in generator and power meter to zero, and return selector switch to CW position. To prevent drift due to temperature change make these adjustments as quickly as possible.

d. Tune signal generator to 3.8 GHz and adjust POWER SET control for zero indication on power set meter.

e. Set attenuator to 7 (-7 dBm). Record frequency and external power meter reading.

f. Repeat step e every 200 MHz across entire frequency range.

g. Plot a dBm-frequency curve from readings obtained in step f (see Figure 5-18). Resulting response curve will consist of a series of peaks and troughs having an amplitude of ± 2.0 dB or less. Draw a straight line (parallel to frequency axis) through response curve in such a way that variations are averaged about the line.

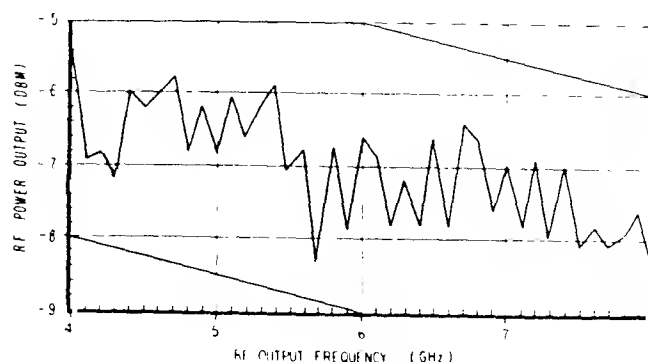


Figure 5-18. Typical Response Curve (618C)

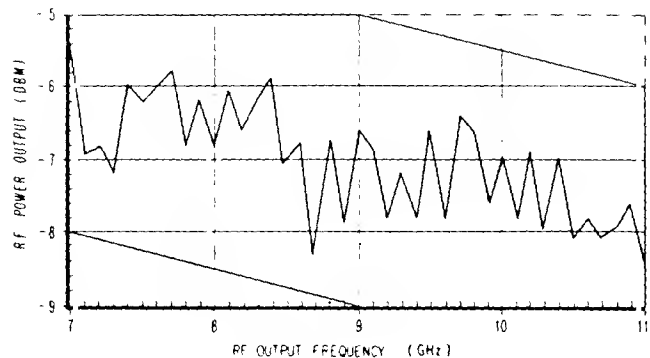


Figure 5-19. Typical Response Curve (620B)

h. Select a frequency where response curve crosses average line drawn in step g and set generator to this frequency.

i. Repeat step c.

j. Set generator output attenuator for -7 dBm reading on power meter and lock attenuator. If attenuator dial does not now read 7 (-7 dBm), remove plate covering hub of dial, loosen set screws holding dial to shaft and slip dial to read -7 dBm. Tighten set screws and replace plate over hub of dial.

k. Repeat steps c and j without changing generator frequency. The readings obtained on external power meter and from output attenuator should be the same. If not, repeat steps c and j until normal indications are obtained.

5-88. REPLACING AND RECALIBRATING THE ATTENUATOR (620B).

5-89. It is not expected that the attenuator dial will require recalibration unless the attenuator assembly is replaced. The attenuator is not ordinarily subject to change or breakage. Small improvements in accuracy may be made by slipping the attenuator dial on the front panel slightly on its shaft to bring into calibration. Following the replacement of the probe, the attenuator assembly must be adjusted for the correct and safe operating depth. The following operation is divided into two parts. The first concerns the replacement of the attenuator probe, and the second concerns the recalibration of the attenuator dial. To determine if the output attenuator is defective, measure the resistance between the center terminal of the RF OUTPUT jack and ground. The resistance should be approximately 50 ohms. A higher resistance indicates the film resistor that composes part of the pickup loop is damaged and the attenuator probe and cable must be replaced.

5-90. REPLACING THE ATTENUATOR PROBE (620B).

5-91. To replace the attenuator probe assembly, proceed as follows:

a. With the signal generator removed from its rack cabinet and disconnected from the line source,

remove nut from rear of the RF OUTPUTS CAL connector and pull attenuator cable from the jack. The center connector and spacing beads are removed with the cable. A new replacement assembly includes these parts already installed.

b. Free the attenuator cable from small clamp and feed cable out top of instrument noting the routing of the cable around the various decks.

c. Mark the attenuator cable where the cable enters the attenuator mounting block. Loosen the cap screw shown in Figure 5-20 on the mounting block holding the attenuator cable. Pull probe straight out.

d. Compare the new probe with the defective probe, marking the new probe at the same distance from the tip as the mark on the defective probe. Insert new probe carefully to the same depth as the original probe making sure that the ground end of the pickup loop points toward the resonator cavity (to the right when facing the Instrument).

e. Tighten cap screw finger-tight so that minor adjustment of the probe depth is still possible.

f. Carefully thread the cable under the cable clamp and around the casting to the front panel. DO NOT twist cable more than a quarter of a turn.

g. Remount RF OUTPUTS CAL connector. Tighten cable clamp.

h. After the attenuator assembly is replaced, an error of a few dB may exist in the calibration of the attenuator dial. Calibration may be checked as described in the following paragraph.

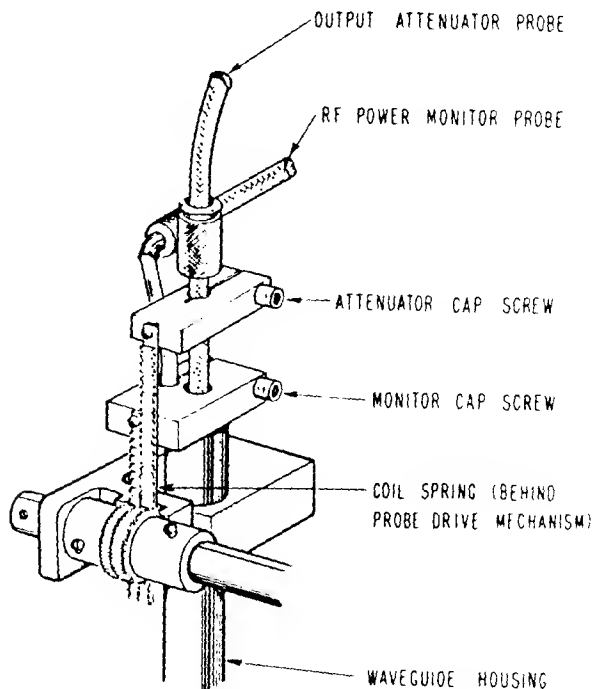


Figure 5-20. Attenuator and Monitor Probe Assemblies (620E)

5-92. RECALIBRATING THE ATTENUATOR (620B).

a. Connect Signal Generator in test setup shown in Figure 5-1. Allow Signal Generator to warm up with MOD. SELECTOR in CW position for at least twenty minutes.

b. Set MOD. SELECTOR to OFF.

c. Adjust Signal Generator to 9 GHz.

d. Connect Power Meter to RF OUTPUT CAL connector; zero meter reading on Power Meter.

e. Set MOD. SELECTOR to CW.

f. Adjust POWER SET control so that the front-panel power meter reads 0.

g. Adjust the OUTPUT ATTEN control to -7 dBm.

WARNING

High voltage is present on the green lead below the attenuator assembly and at the terminals on the potentiometer above the frequency-drive casting. Be extremely careful not to touch these components when adjusting the attenuator probe with the instrument turned on.

h. Gently adjust the probe depth so that the external power meter indicates -7 dBm. Tighten the cap screw on the attenuator probe.

5-93. An initial setting has now been made that will be accurate within approximately ± 5 dB. To refine this setting and obtain the original calibration accuracy of ± 2 dB it is necessary to measure the output of the signal generator across the frequency range and construct a graph showing the frequency response of the instrument. Figure 5-19 shows such a graph with a typical response curve after the power output curve has been centered about the -7 dBm reference level. The final adjustment is made by slipping the attenuator dial, while measuring the RF output level at a convenient frequency on the curve, to bring the total power spread to be within the ± 2 dB limits of the -7 dBm reference level. The limits are indicated by the heavy transverse lines above and below the -7 dBm center line. Proceed as follows:

a. Assuming the Signal Generator is at normal operating temperature, set MOD. SELECTOR to OFF and zero the external power meter.

b. Set MOD. SELECTOR to CW and tune frequency dial to 7 GHz.

c. Adjust POWER SET control so that Meter indicates 0.

d. Check that OUTPUT ATTEN control is set to -7 dBm.

e. Record the reading on the external Power Meter.

f. Repeat steps c through e every 200 MHz from 7 GHz to 11 GHz. Plot the resulting data as a response curve such as the one shown in Figure 5-19.

g. This curve should consist of a series of peaks and troughs with a maximum range of ± 2 dBm.

h. Equalize the maximum excursions on each side of -7 dBm by slipping the attenuator dial. The dial is made free of the drive shaft by removing the hub cover from the center of the attenuator dial and loosening the two Allen screws in the periphery of the hub.

5-94. TUBE AND SEMICONDUCTOR REPLACEMENT.

5-95. Table 5-6 lists checks to be made after replacement of certain electron tubes and semiconductors (e.g., diodes, transistors). Replacement of unlisted items does not affect critical Signal Generator functions or operating voltages.

Note

Do not change an operating voltage or calibration adjustment unless it is either definitely outside specified tolerance or calibration accuracy of a dependent function is unsatisfactory. Improving a marginal adjustment can adversely affect calibration.

5-96. ETCHED CIRCUITS.

5-97. The etched circuit boards in the Signal Generator are of the plated-through type consisting of metallic conductors bonded to both sides of insulating material. The metallic conductors are extended through the component mounting holes by a plating process. Soldering can be done from either side of the board with equally good results. Table 5-7 lists recommended tools and materials. Following are recommendations and precautions pertinent to etched circuit repair work.

a. Avoid unnecessary component substitution; it can result in damage to the circuit board and/or adjacent components.

b. Do not use a high-power soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.

c. Use a suction device (Table 5-7) or wooden toothpick to remove solder from component mounting holes. **DO NOT USE A SHARP METAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OBJECTS MAY DAMAGE THE PLATED-THROUGH CONDUCTOR.**

d. After soldering, remove excess flux from the soldered areas and apply a protective coating to prevent contamination and corrosion. See Table 5-7 for recommendations.

e. When removing a multiple-connection component held tightly in a socket, such as a vacuum tube, loosen it gradually using gentle side-to-side or rotary motion to avoid damage to the plated-through conductors.

Table 5-6. Checks Following Tube and Semiconductor Replacement

| Reference Designation | Check | Paragraphs |
|-----------------------|---|------------|
| V103 | PULSE RATE control calibration | 5-33 |
| V107 | PULSE DELAY control calibration | 5-35 |
| V111 | PULSE WIDTH control calibration | 5-37 |
| V114 | Klystron frequency, current and voltage | 5-29 |
| V301 thru V305 | -300V supply voltage | 5-27 |
| V401 thru V405 | -1000V supply voltage | 5-27 |
| V501 thru V504 | -1500 supply voltage | 5-27 |
| CR601 thru CR602 | Power meter calibration | 5-39 |
| Q601 thru Q603 | Power meter calibration | 5-39 |

5-98. COMPONENT REPLACEMENT.

- a. Remove defective component from circuit board.

Note

Axial lead components, such as resistors and tubular capacitors, can be replaced without unsoldering. Clip leads near body of defective component, remove component and straighten leads left in board. Wrap leads of replacement component one turn around original leads. Solder wrapped connection, and clip off excess lead.

- b. Remove solder from mounting holes using a suction desoldering aid (Table 5-7) or wooden toothpick.

- c. Shape leads of replacement component to match mounting hole spacing.

- d. Insert component leads into mounting holes, and position component as original was positioned. DO NOT FORCE LEADS OF REPLACEMENT COMPONENT INTO MOUNTING HOLES. Sharp lead ends may damage plated-through conductor.

Table 5-7. Etched Circuit Soldering Equipment

| Item | Use | Specification | Item Recommended |
|-----------------------------------|--|---|---|
| Soldering Tool | Soldering Unsoldering | Wattage rating: 37.5 Tip Temp: 750-800°F Tip Size: 1/8" OD | Ungar #776 Handle with Ungar #1237 Heating Unit |
| Soldering Tip, general purpose | Soldering Unsoldering | Shape: chisel Size: 1/8" | Ungar #PL113 |
| De-soldering aid | Unsoldering multi-connection components (e.g., tube sockets) | Suction device to remove molten solder from connection | Soldapult by the Edsyn Company, Arleta, California |
| Resin (flux) solvent | Remove excess flux from soldered area before application of protective coating | Must not dissolve etched circuit base board material or conductor bonding agent | Freon Acetone Lacquer Thinner Isopropyl Alcohol (100% dry) |
| Solder | Component replacement Circuit board repair Wiring | Resin (flux) core, high tin content (60/40 tin/lead), 18 gauge (SWG) preferred | |
| Protective Coating | Contamination, corrosion protection after soldering | Good electrical insulation, corrosion-prevention properties | Krylon ® #1302* Humiseal Protective Coating, Type 1B12 by Columbia Technical Corp. Woodside 77, New York |

*Krylon, Inc., Norristown, Pennsylvania

5-99. **TUBE SOCKET REPLACEMENT.** There are three ways to remove a tube socket from the etched circuit boards:

a. Cut terminals attaching socket to circuit board, remove socket, and unsolder remaining terminal pieces individually.

b. Using long nose pliers, break insulating material of socket away from metal connectors, then unsolder connectors from board individually.

c. Use a special soldering iron tip designed to heat all socket connections simultaneously and remove socket as a unit; or use a suction device (Table 5-7) to desolder all connections and remove socket.

5-100. **ETCHED CONDUCTOR REPAIR.** A broken or burned section of conductor can be repaired by bridging the damaged section with a length of tinned copper wire. Allow adequate overlap and remove any varnish from etched conductor before soldering wire into place.

5-101. **TRANSISTOR AND SEMICONDUCTOR DIODE REPLACEMENT.**

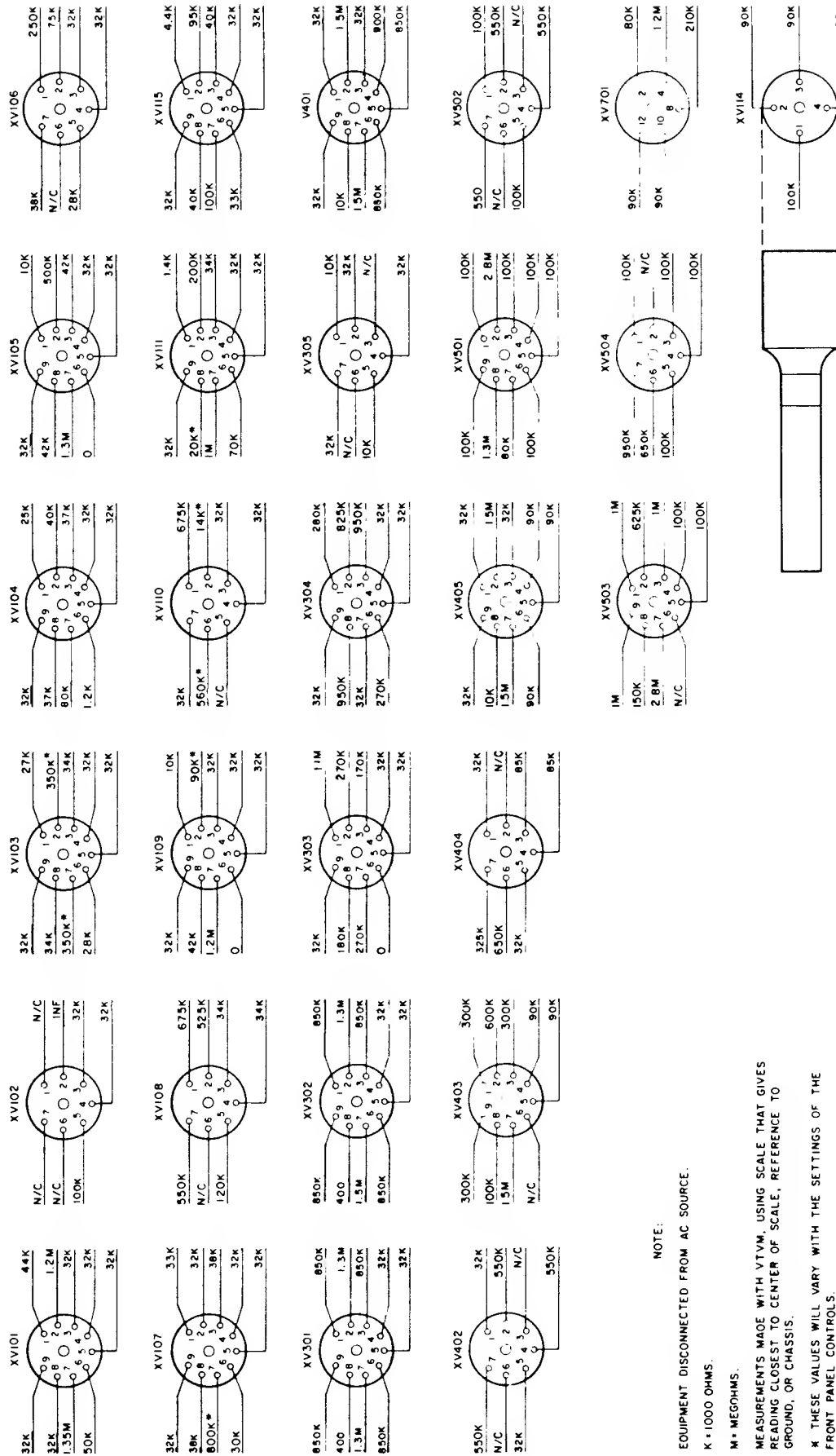
a. Do not apply excessive heat. See Table 5-7 for soldering tool specifications.

b. Use a heat sink such as pliers or hemostat between transistor body and hot soldering iron.

c. When installing a replacement transistor, ensure sufficient lead length to dissipate heat of soldering by maintaining about the same length of exposed lead as used for original transistor.

5-102. Q601, Q602 LEAD IDENTIFICATION.

5-103. Transistors Q601 and Q602 are dual transistors (i.e., two transistors in one case). For this configuration, the locating tab which protrudes from the rim of the transistor case identifies the collector, not the emitter.



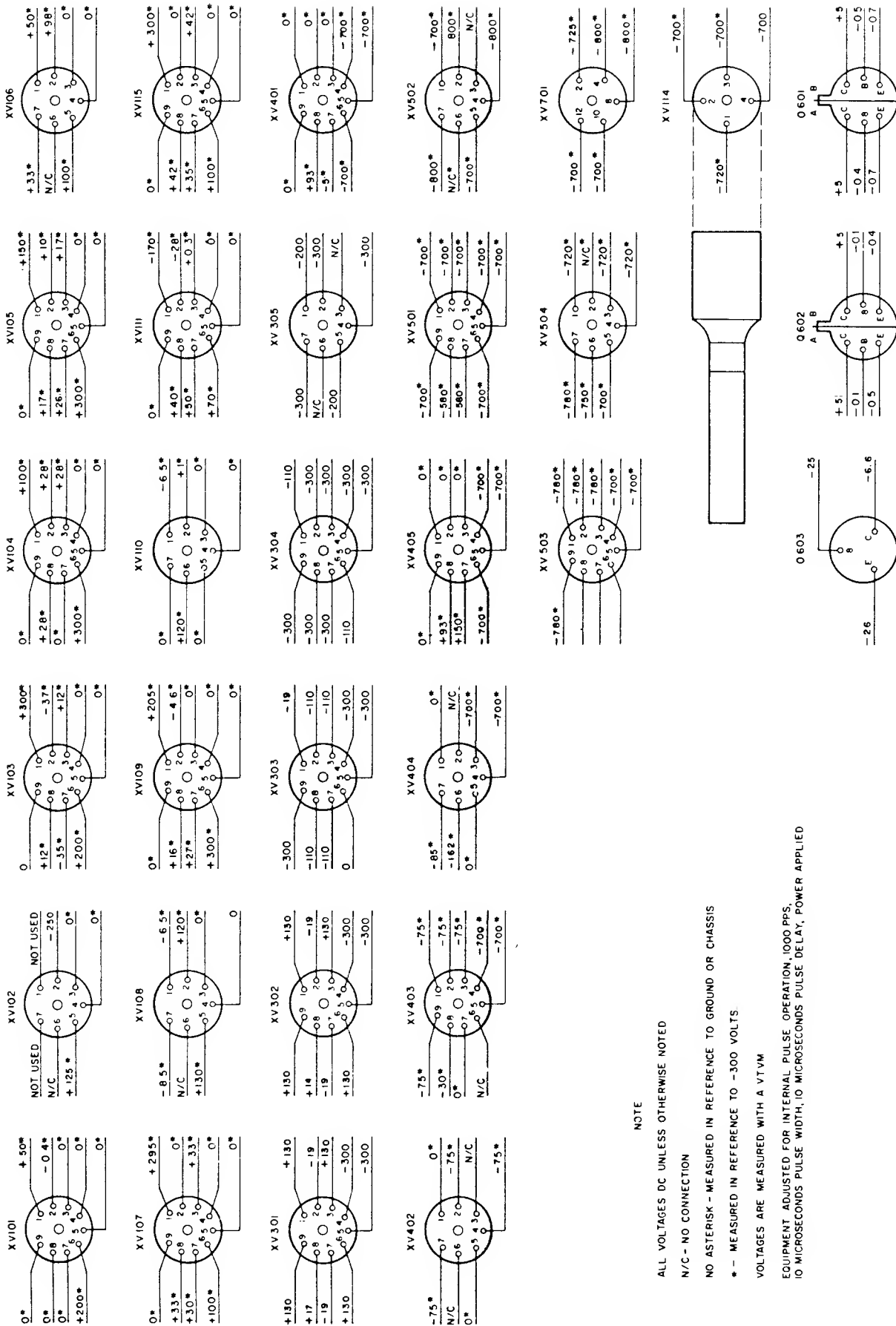


Figure 5-22. Voltage Chart

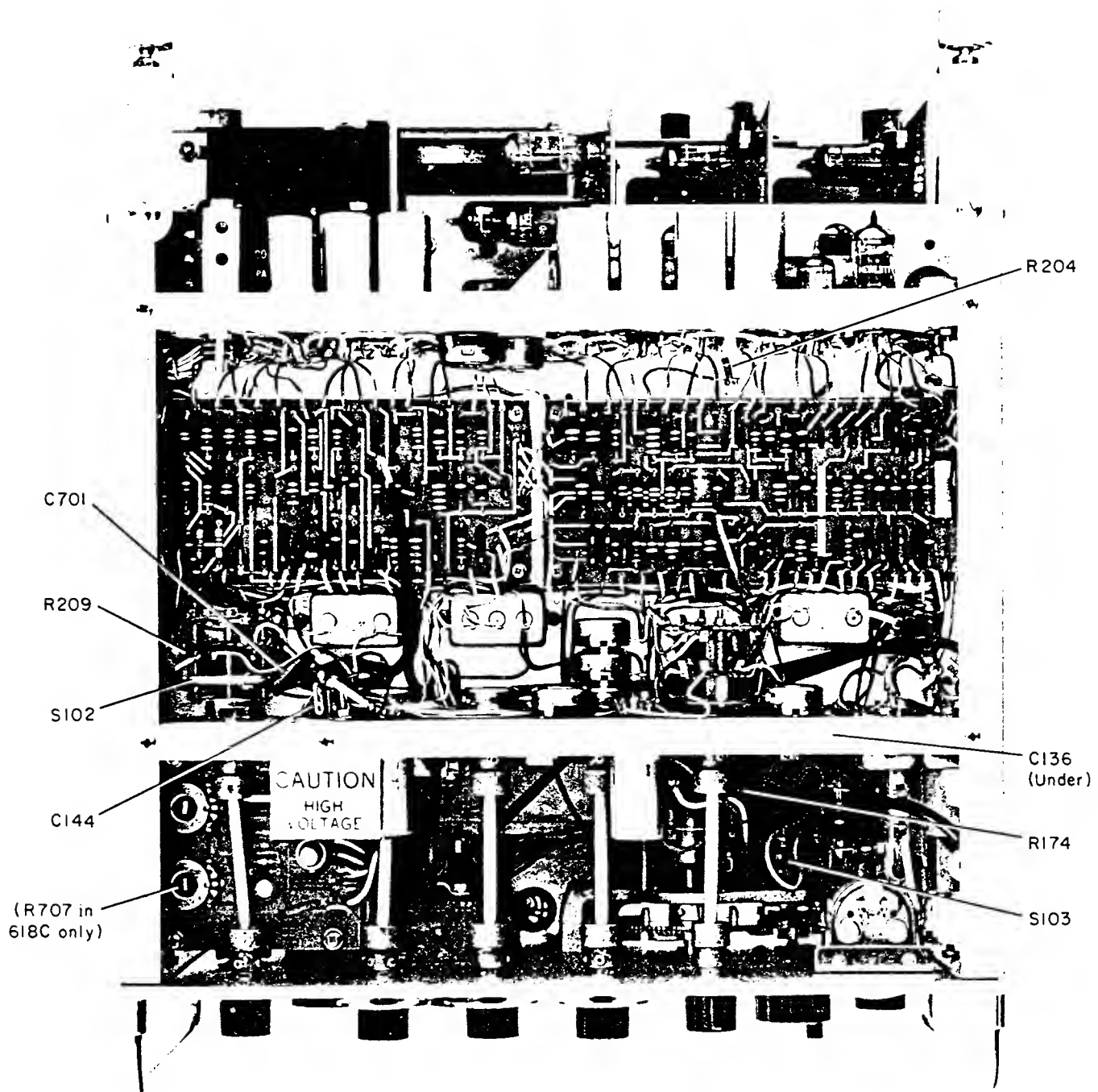


Figure 5-23. Interior View Showing Locations of Unlabeled Chassis Components (Top View)

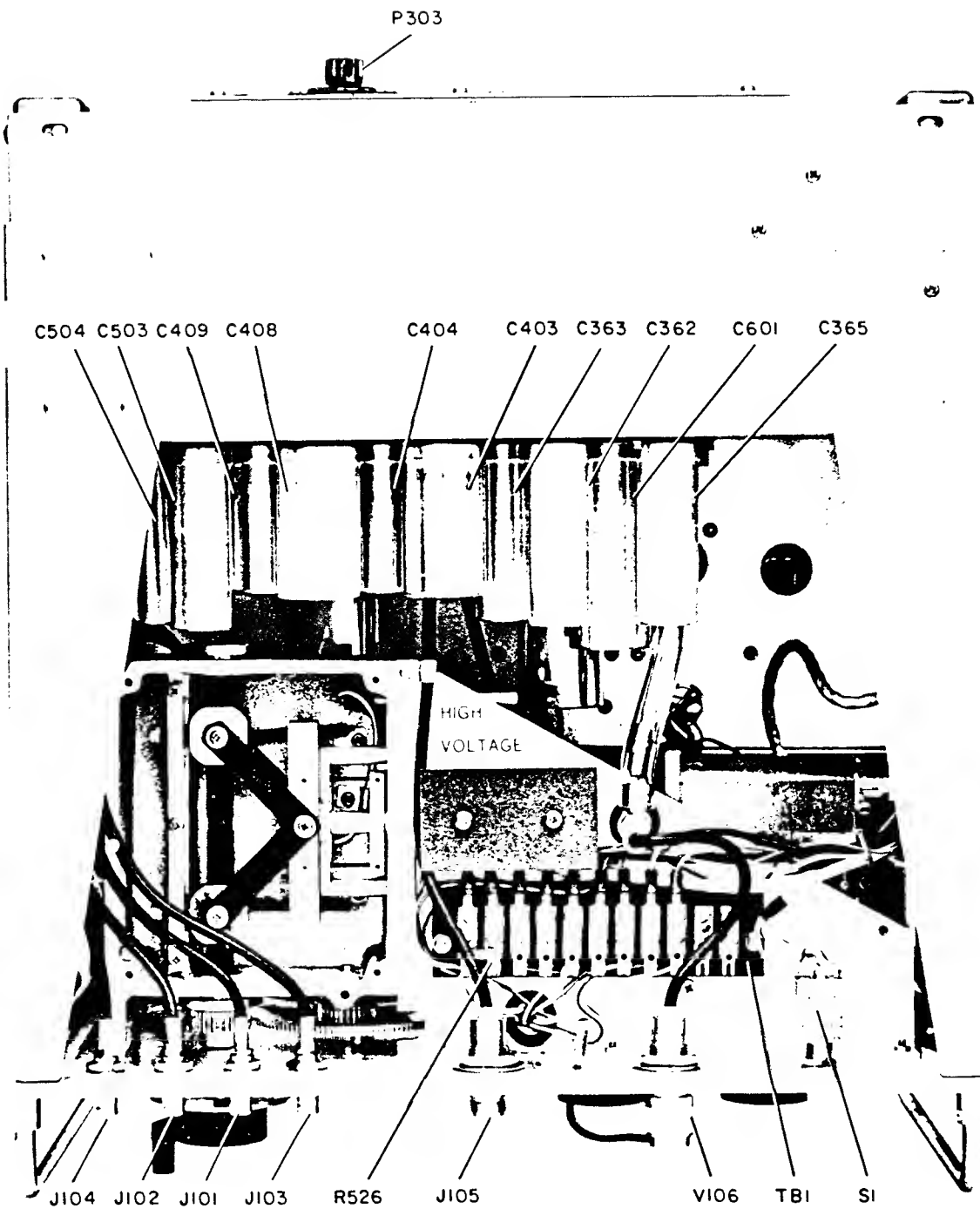


Figure 5-24. Component Identification, Bottom Interior View

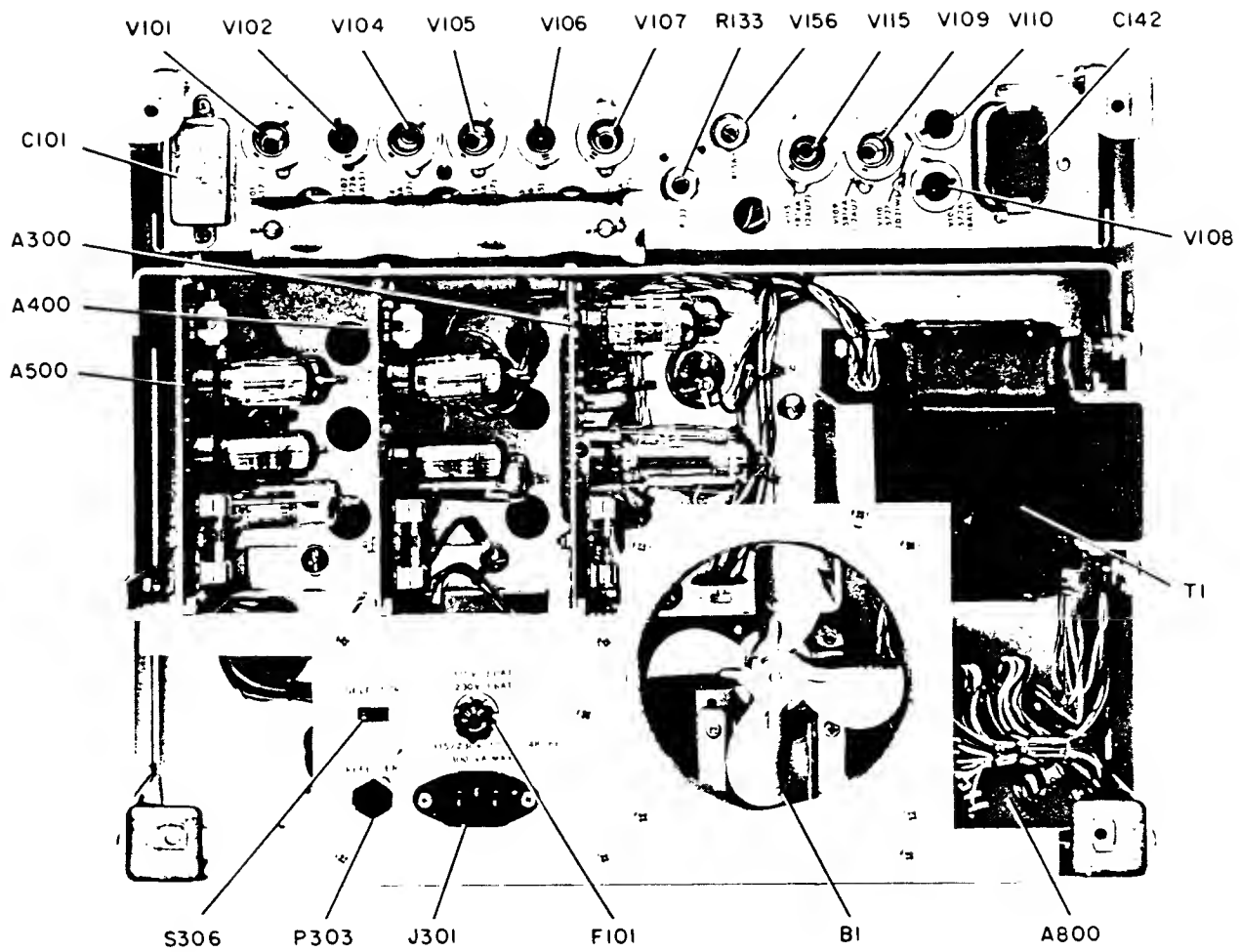





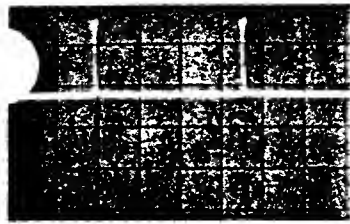


Figure 5-25. Component Identification, Rear Interior View

1. Resistance in ohms, capacitance in microforads unless otherwise noted
2.  screwdriver adjust
3.  front panel designation
4.  test point
5.  voltage regulator (breakdown) diode
6.  Encloses wire color code. Code used (MIL-STD-681) is the same as the resistor color code. First number identifies the base color, second number the wider stripe, and the third number identifies the narrower stripe. E.G., 947 denotes white base, yellow wide stripe, violet narrow stripe.
7. Waveform taken with Oscilloscope adjusted for ac coupling
8. Except for test point 23, all waveforms taken with front panel controls set as follows:

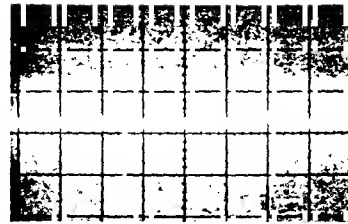
MOD SELECTOR - INT
 PULSE WIDTH - 10
 PULSE DELAY - 0
 PULSE RATE - 200
 FM AMPLITUDE - Fully cw
9. Waveform taken at test point 23 taken with front panel controls set as listed in note 7 except MOD SELECTOR is set to INT FM.
10. Voltages shown on schematic diagrams are with respect to chassis ground.

Figure 5-26. Notes Pertaining to Waveform and Schematic Diagrams



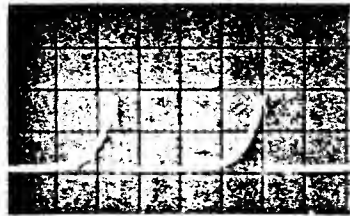
0.2 MS/CM
0.2 V/CM

Test Point 14
(Notes 7
and 8)



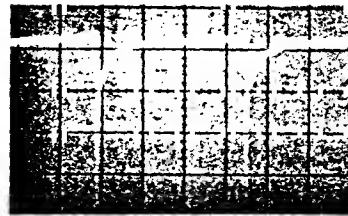
0.2 MS/CM
2 V/CM

Test Point 15
(Notes 7
and 8)



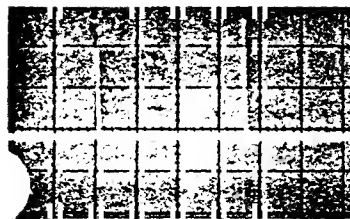
0.2 MS/CM
0.05 V/CM

Test Point 16
(Notes 7
and 8)



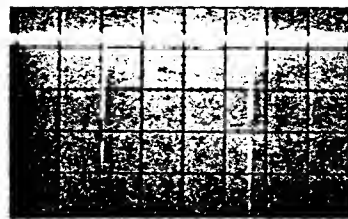
0.2 MS/CM
0.5 V/CM

Test Point 17
(Notes 7
and 8)



0.2 MS/CM
2 V/CM

Test Point 18
(Notes 7
and 8)



0.2 MS/CM
0.2 V/CM

Test Point 19
(Notes 7
and 8)



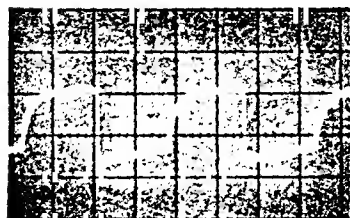
0.2 MS/CM
0.5 V/CM

Test Point 20
(Notes 7
and 8)



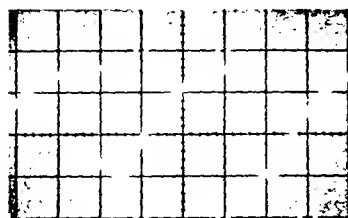
0.2 MS/CM
0.1 V/CM

Test Point 21
(Notes 7
and 8)



0.2 MS/CM
5 V/CM

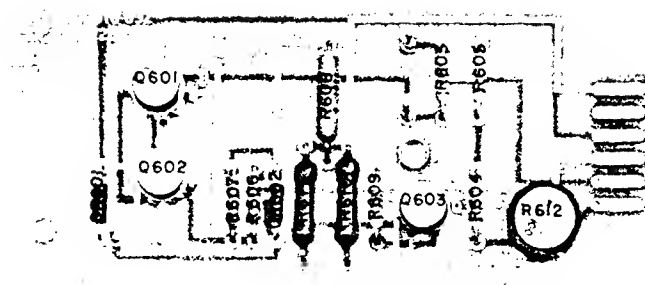
Test Point 22
(Notes 7
and 8)



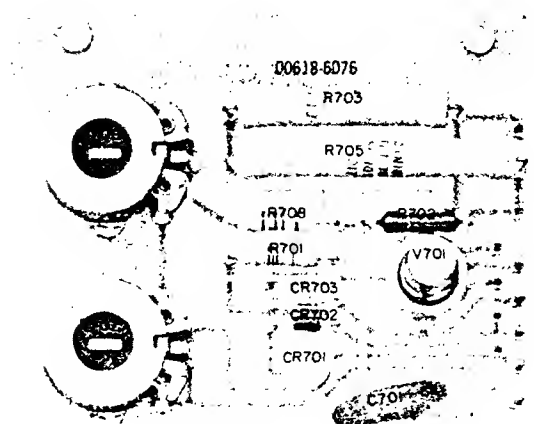
0.2 MS/CM
5 V/CM

Test Point 24
(Notes 7
and 9)

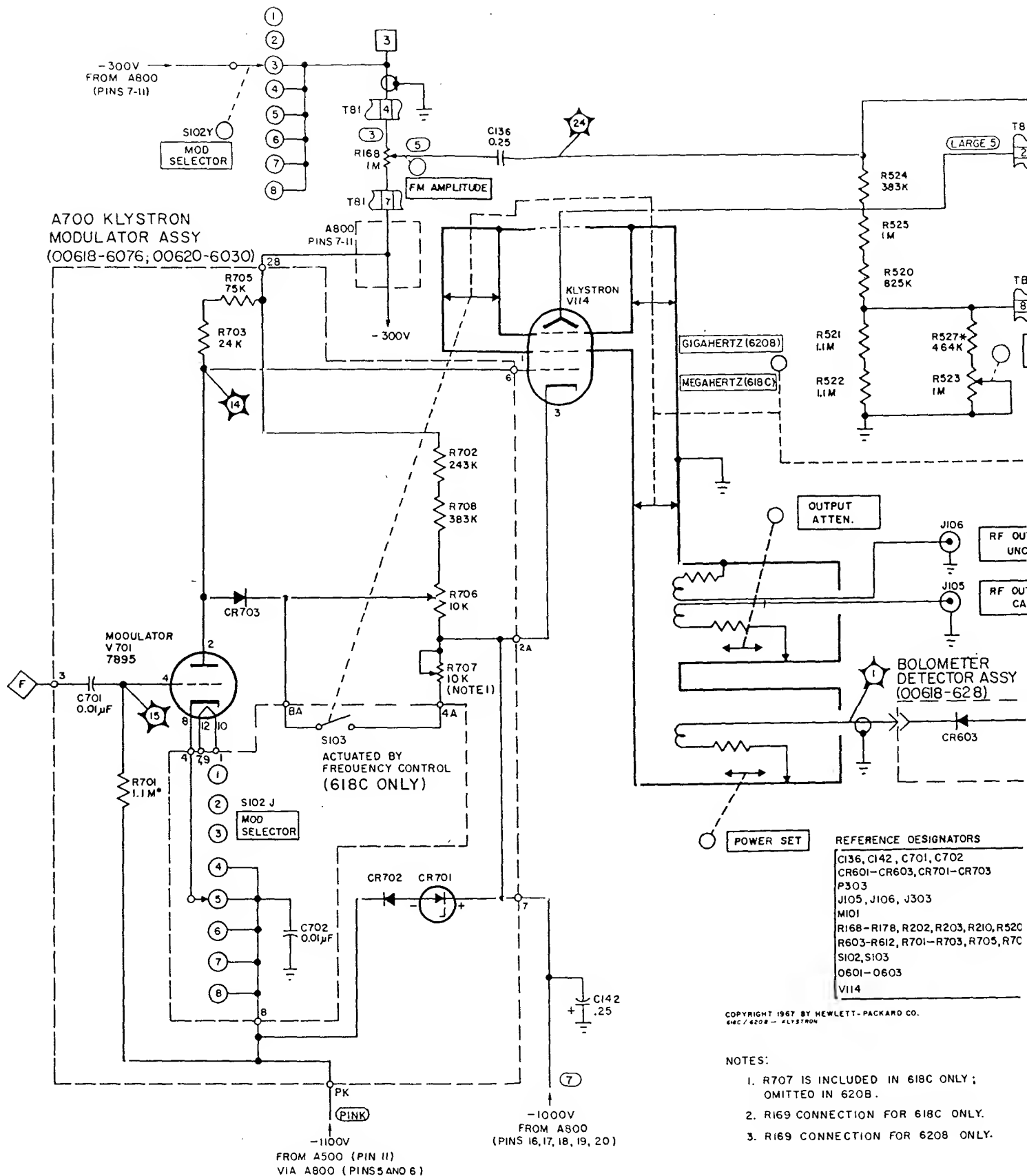
Figure 5-27. Waveforms



Component Identification, A600



Component Identification, A700



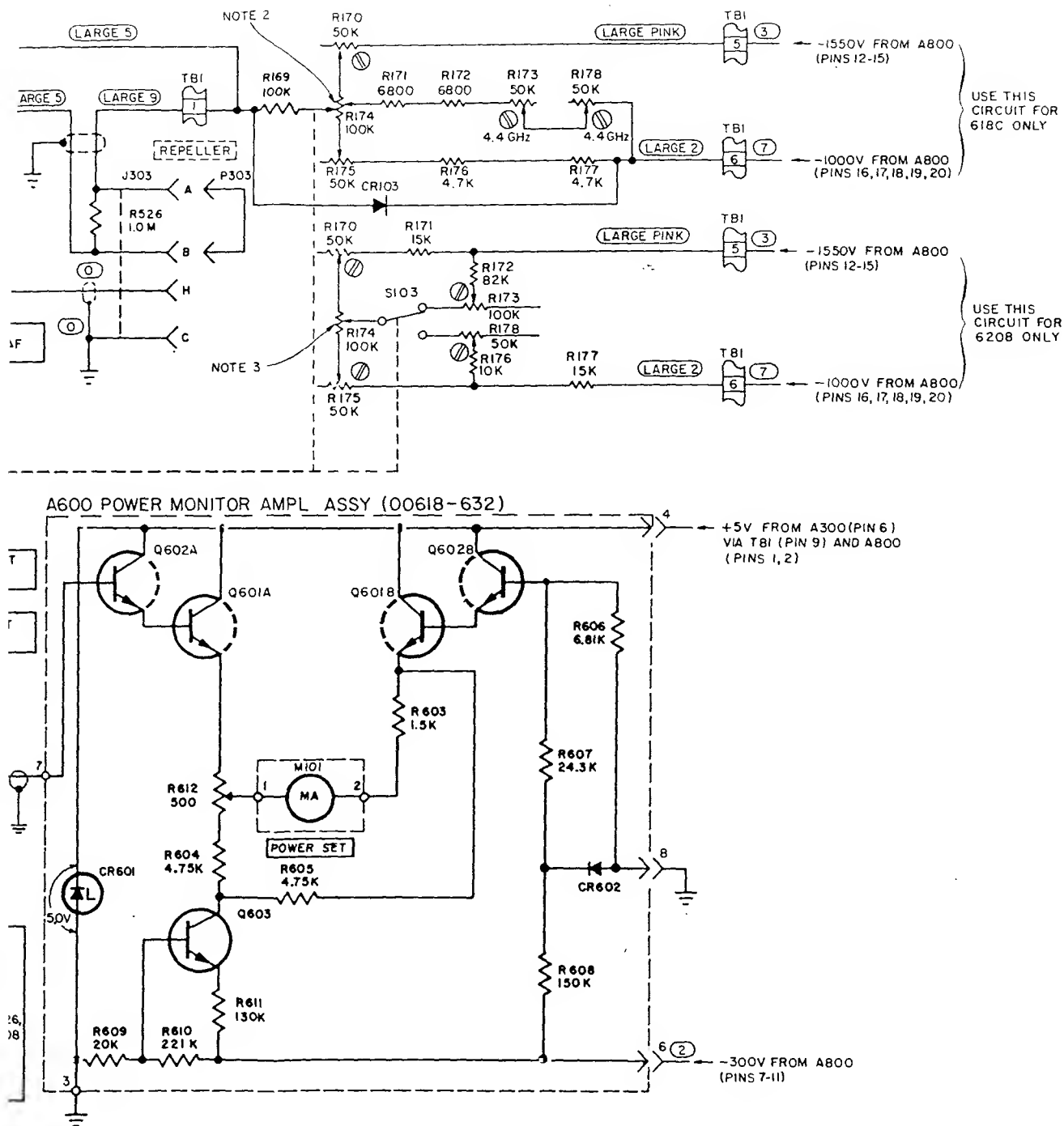
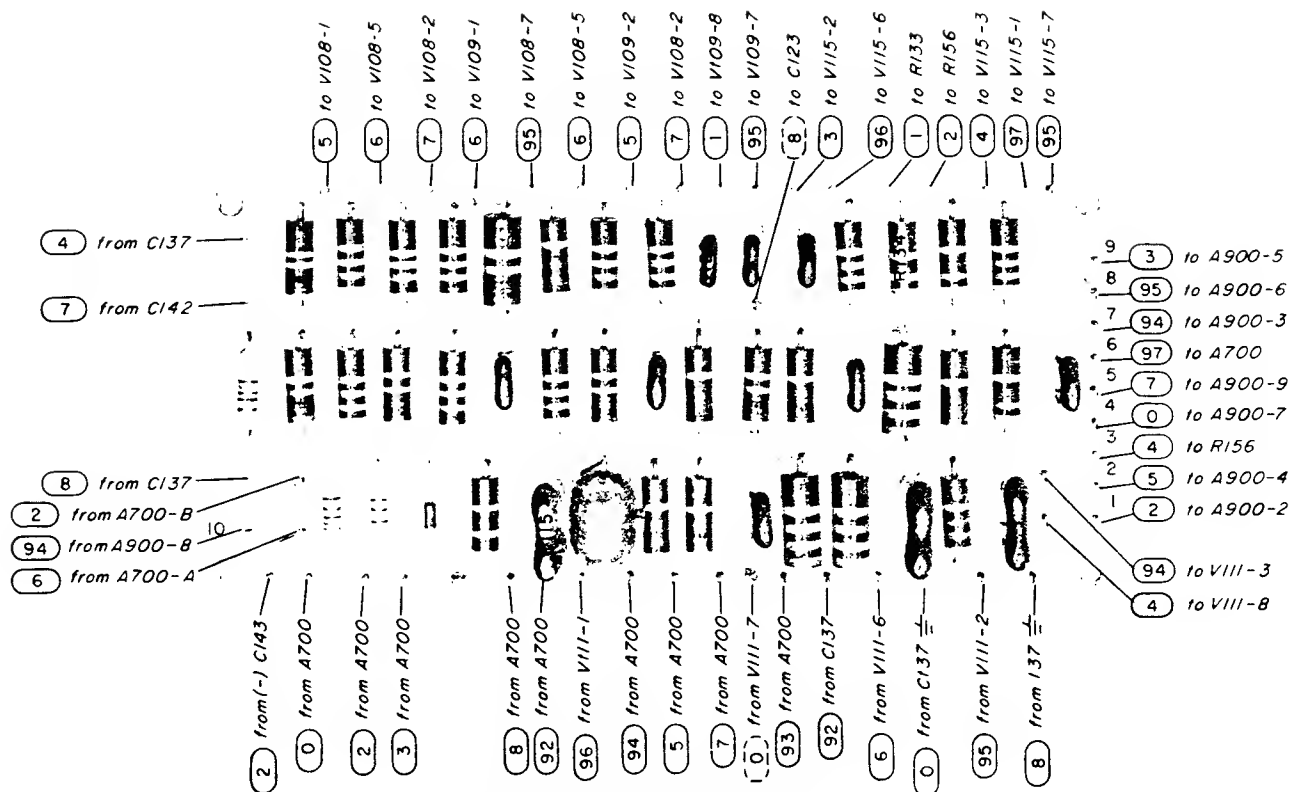
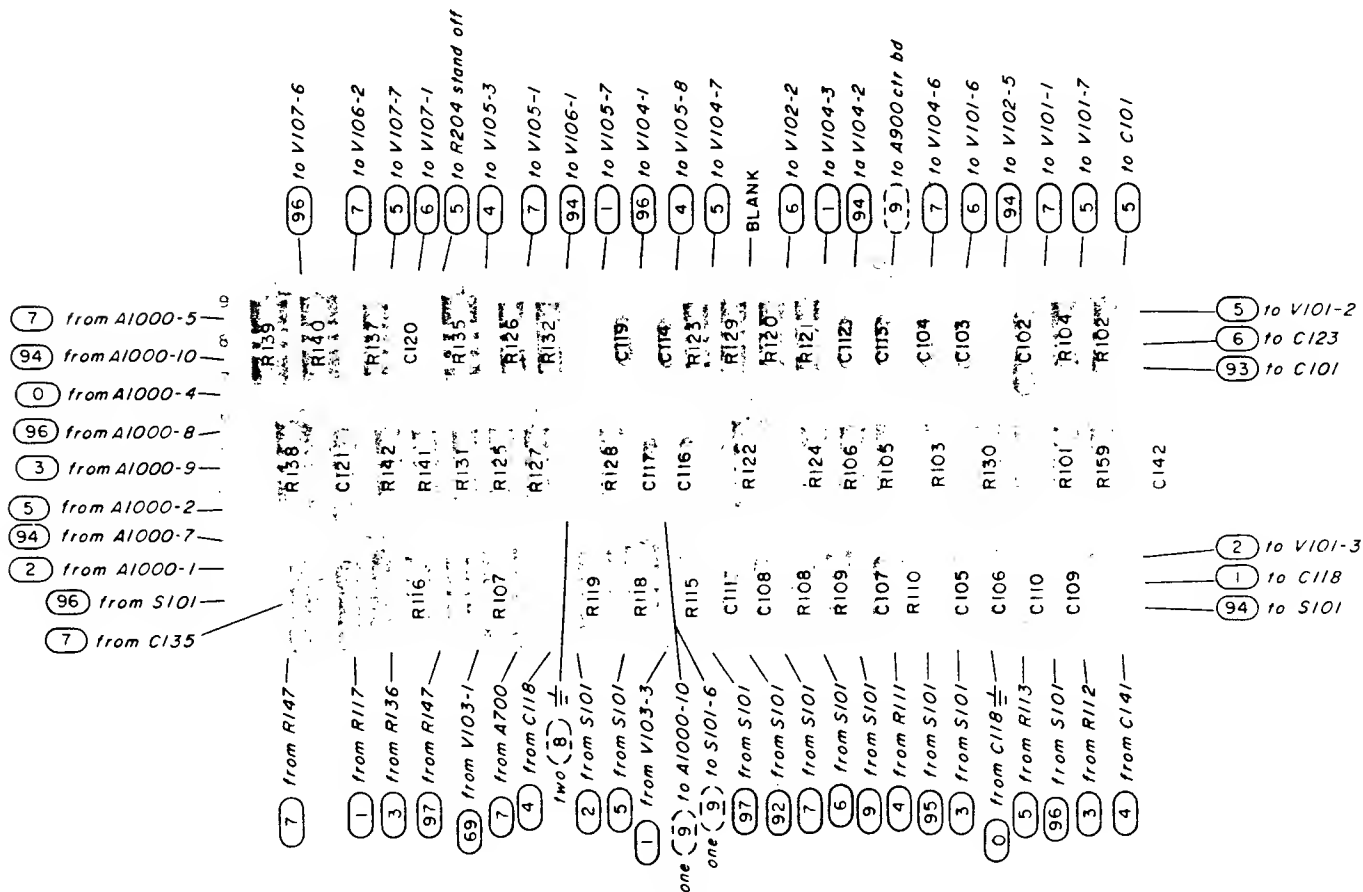


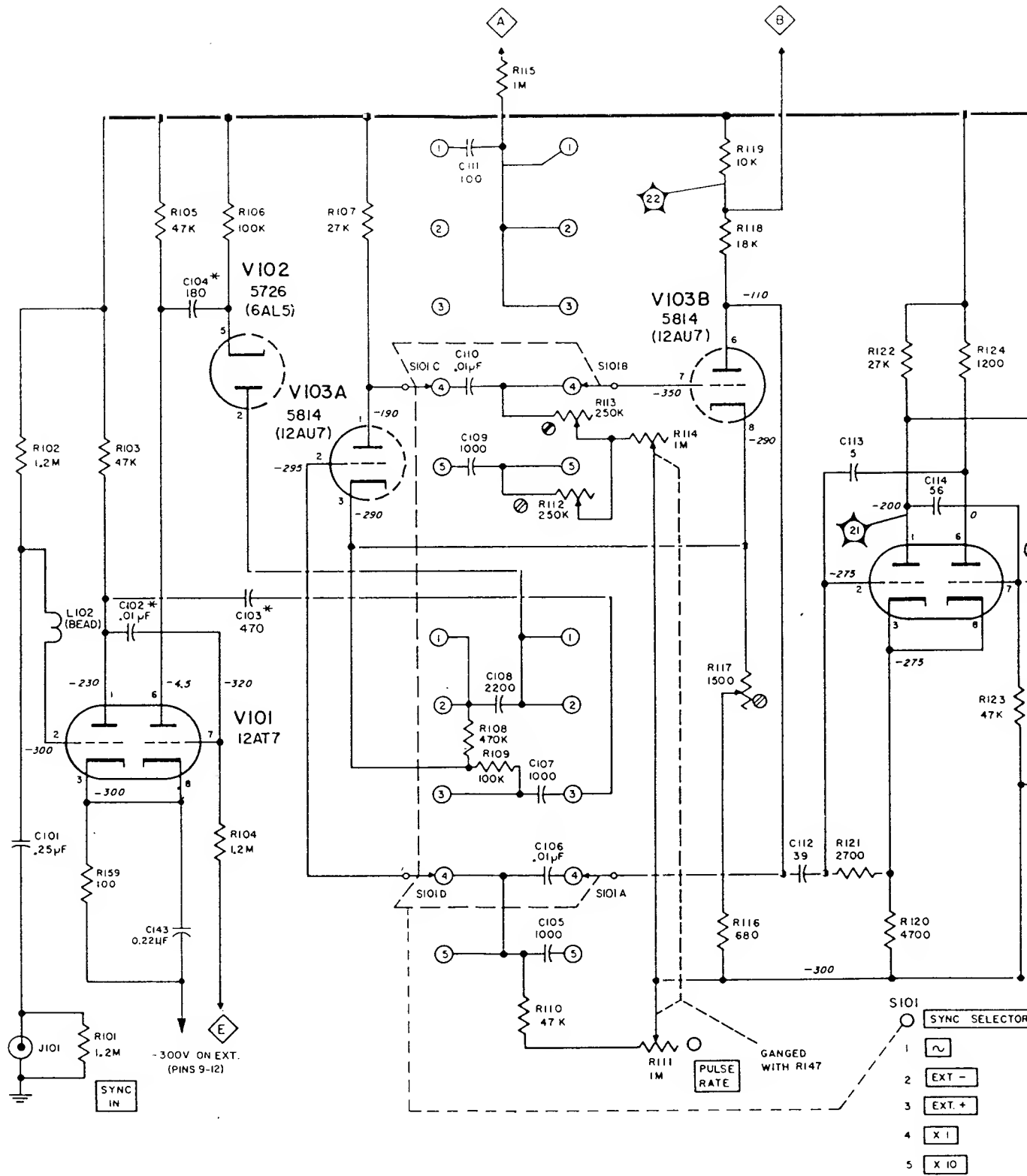
Figure 5-28. Klystron Section

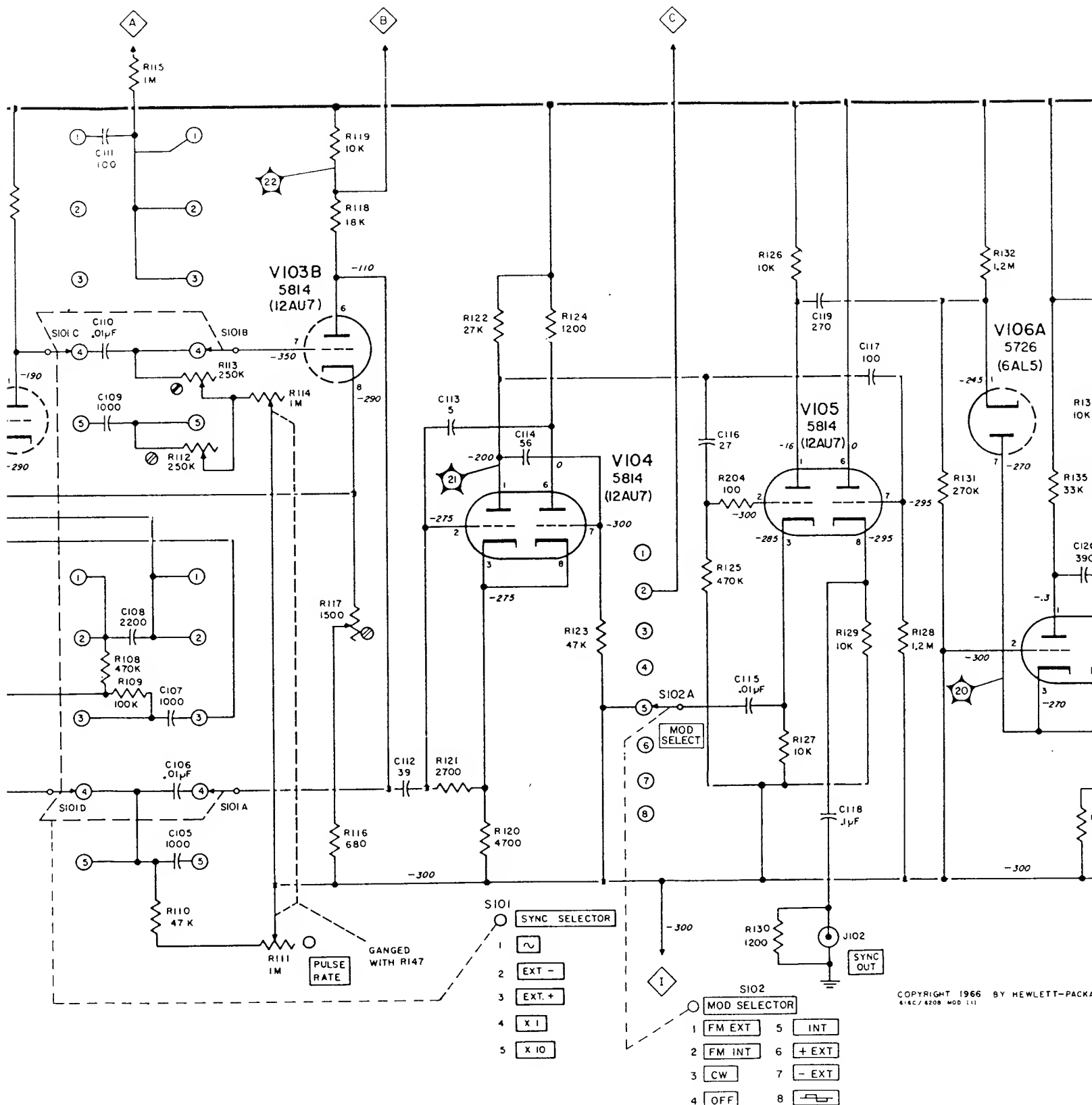


Component Identification, A900



Component Identification, A1000





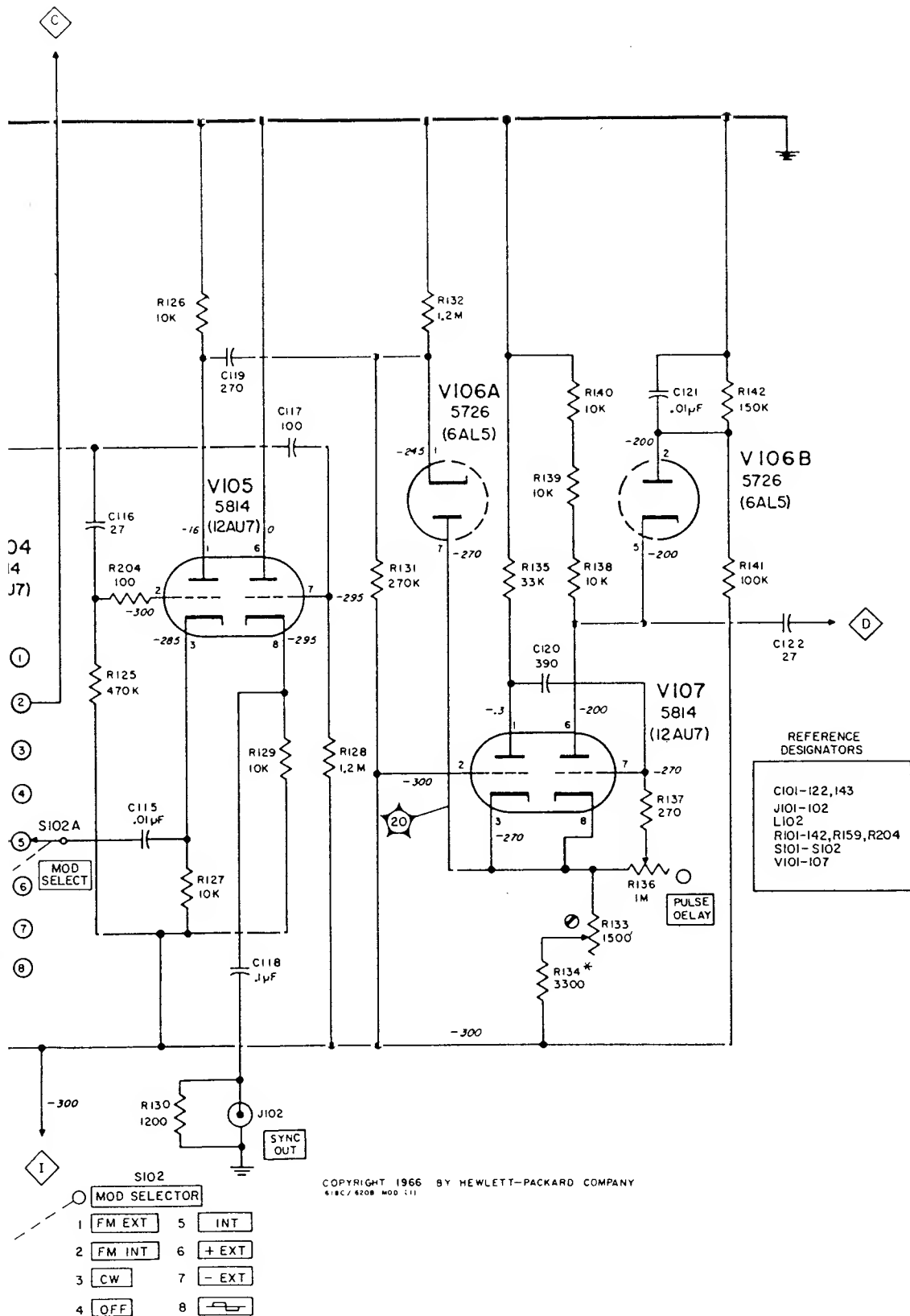
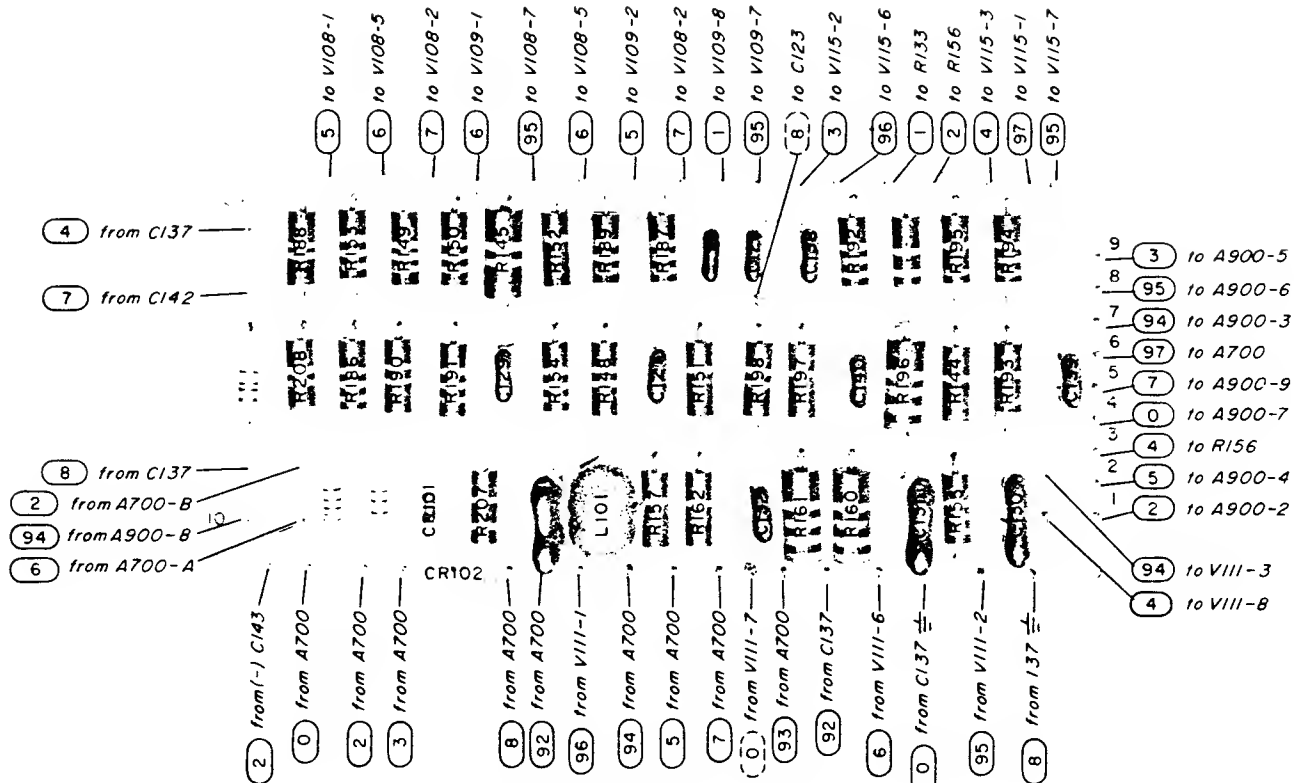
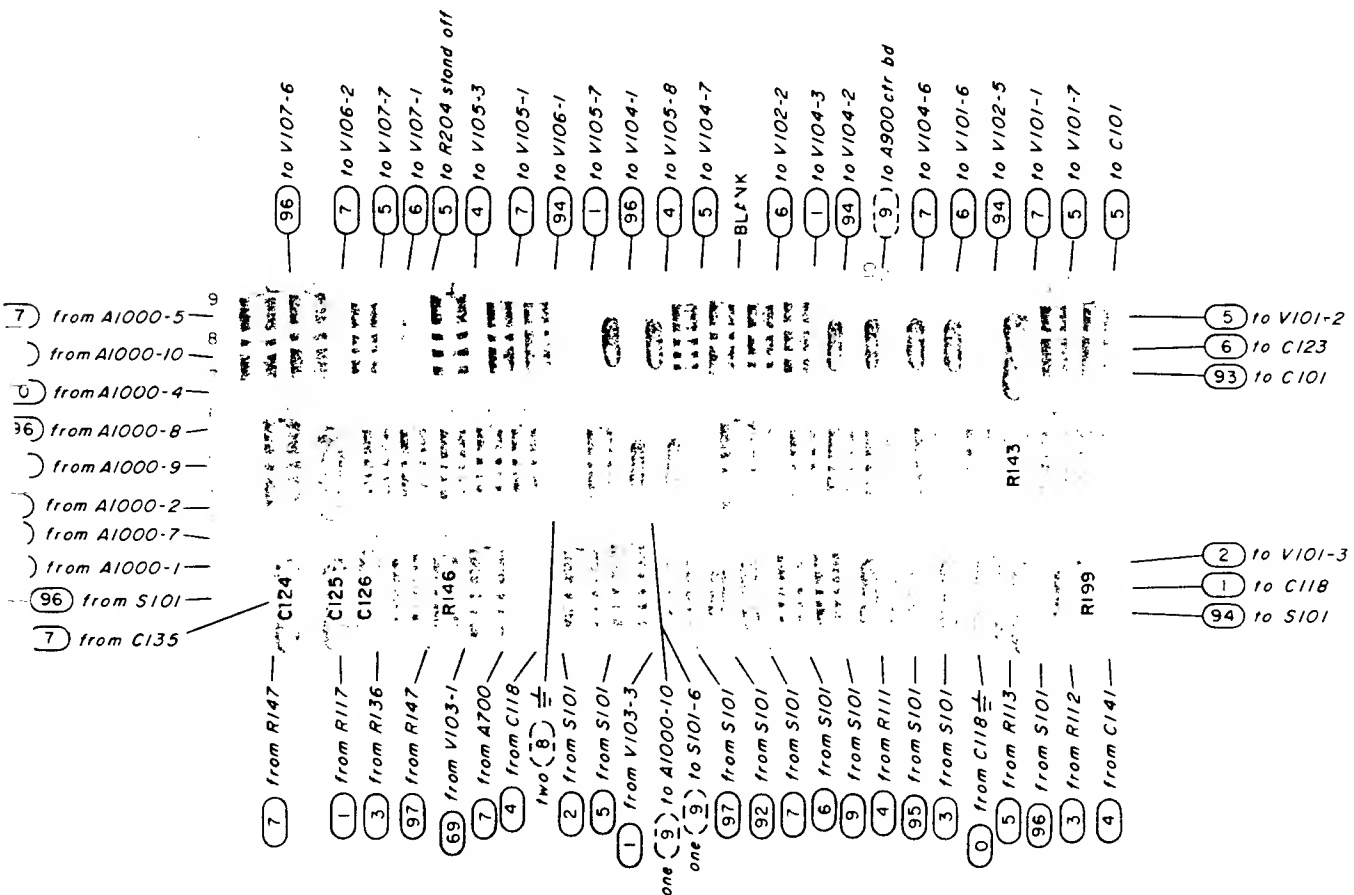


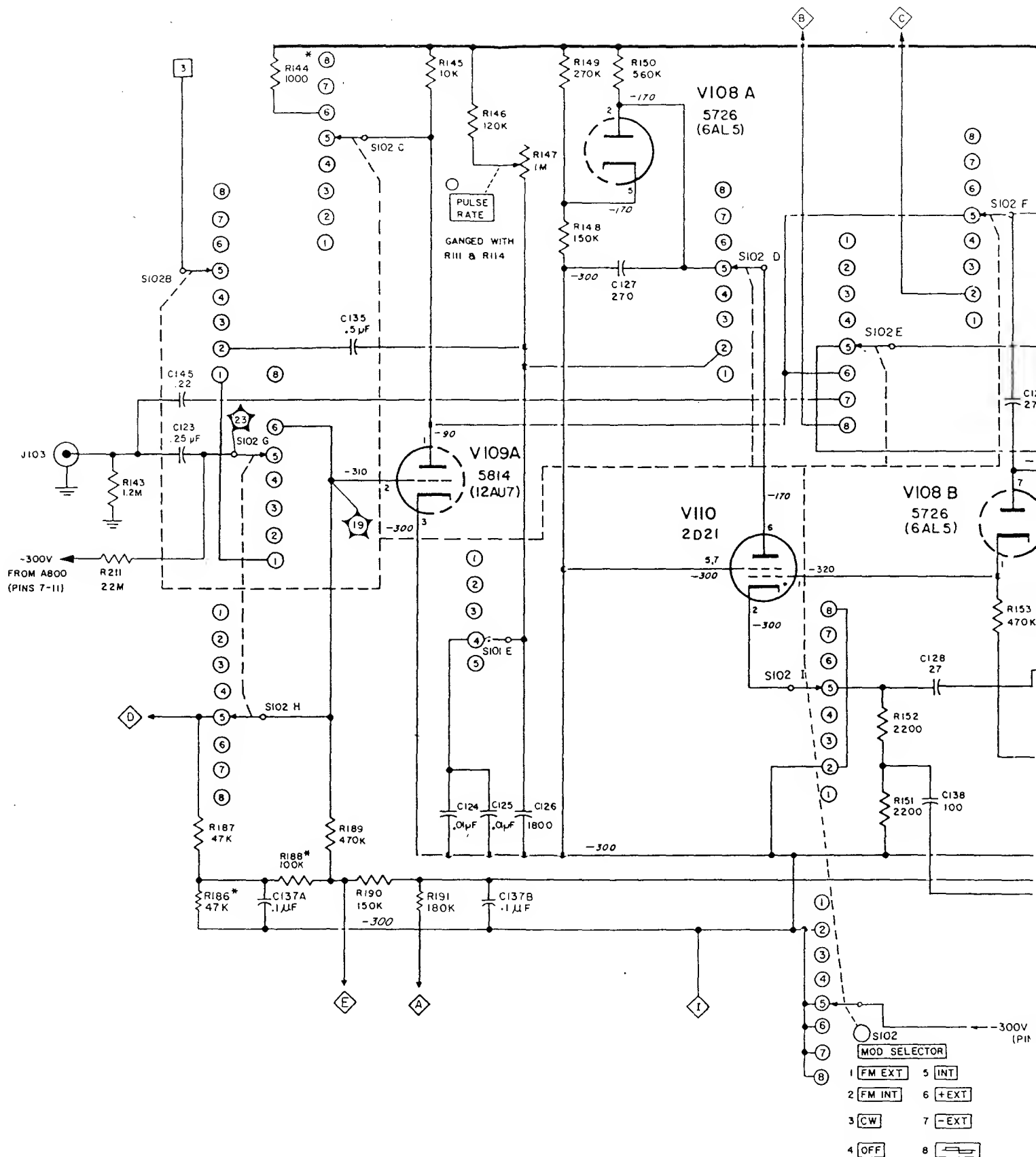
Figure 5-29. Modulator Section (Part 1 of 2)

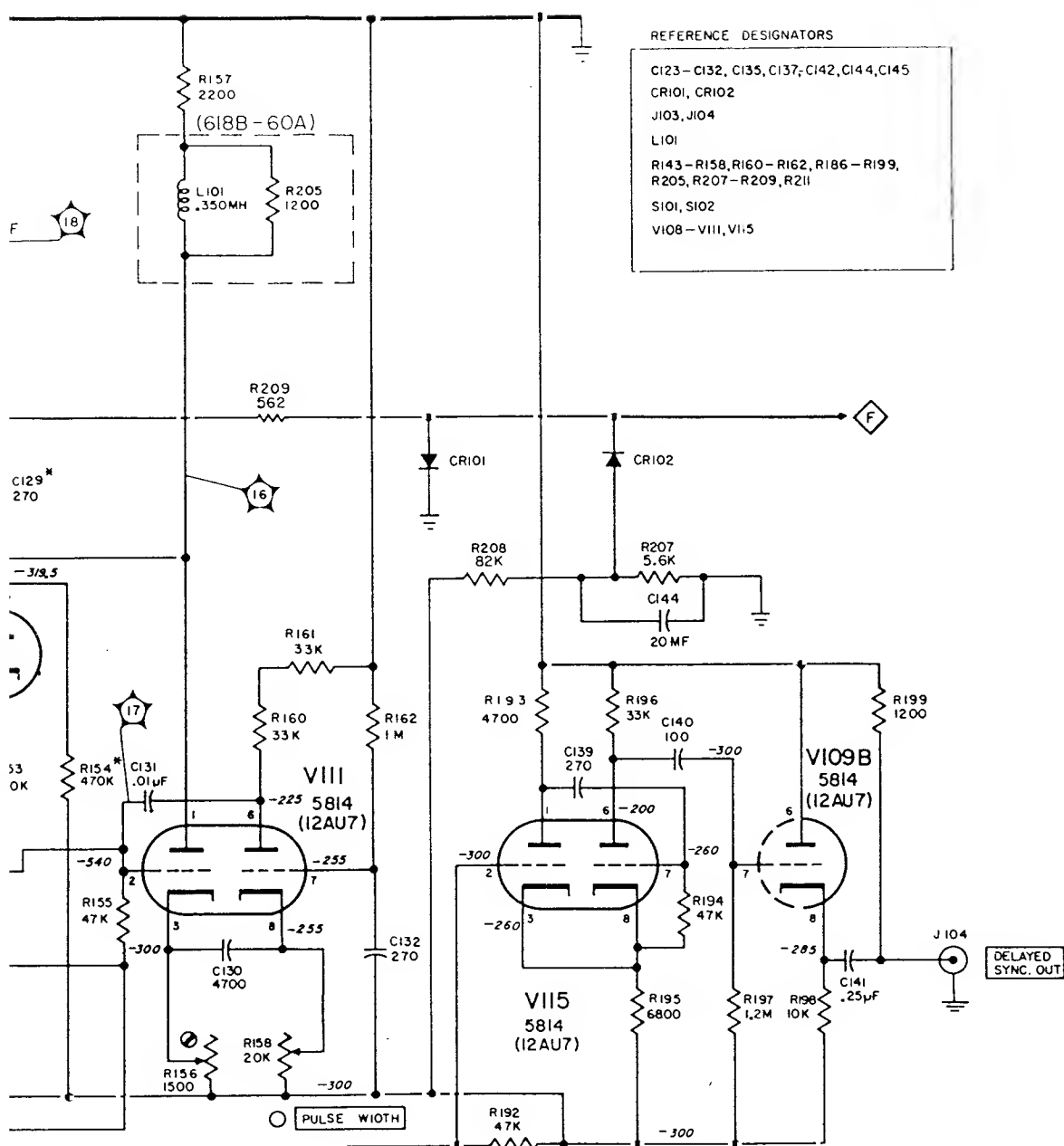


Component Identification, A900



Component Identification, A1000

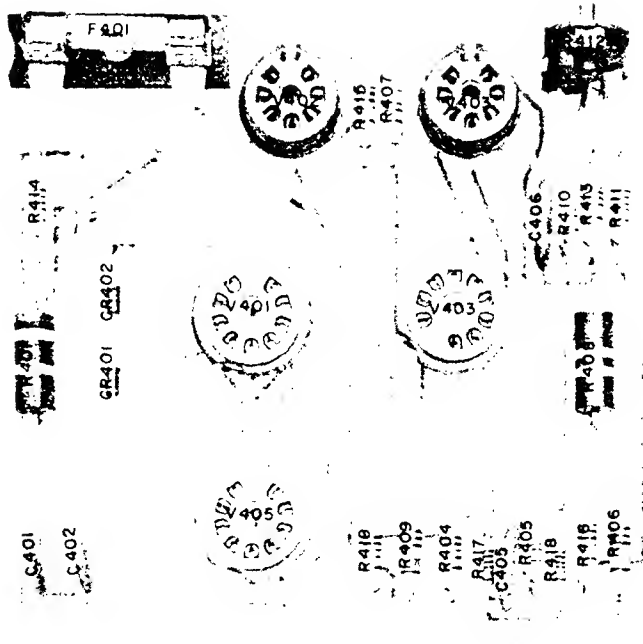




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V FROM A800
 INS 7-11)

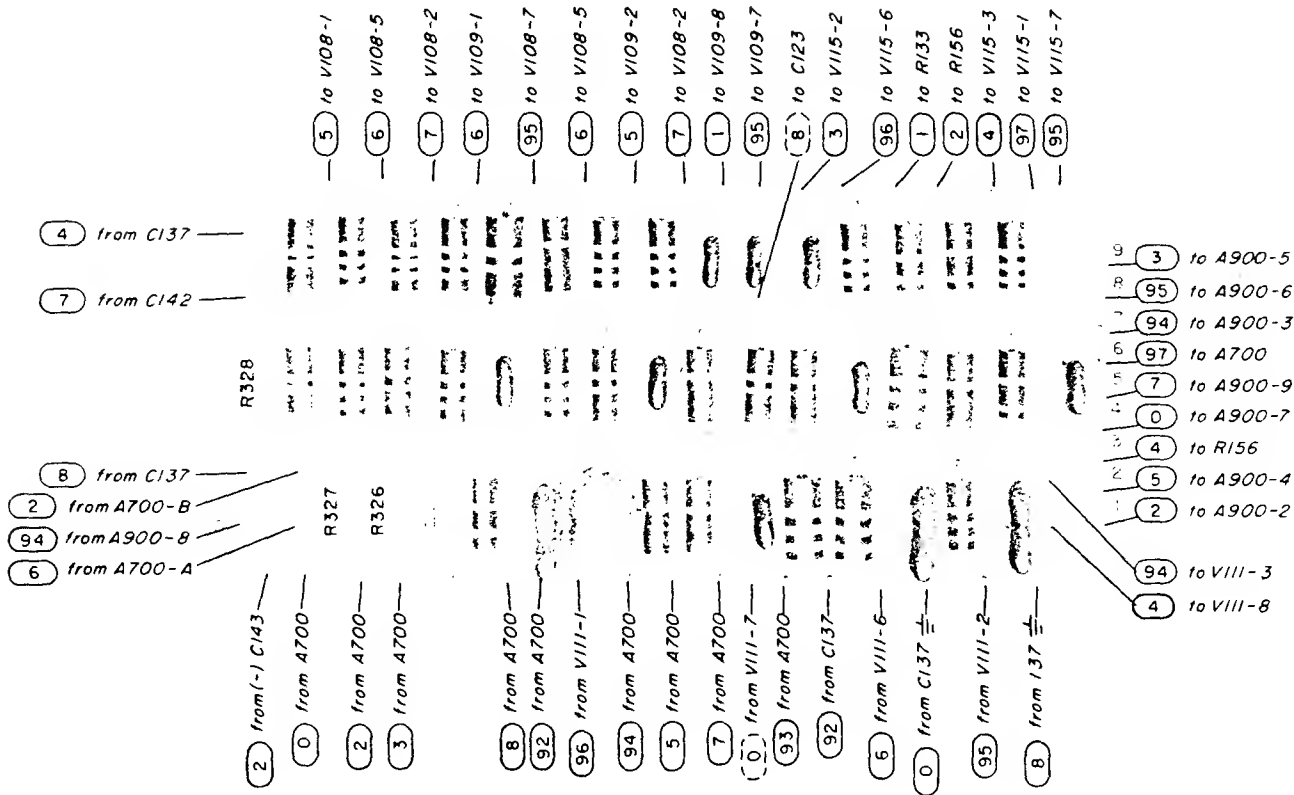
Figure 5-30. Modulator Section (Part 2 of 2)



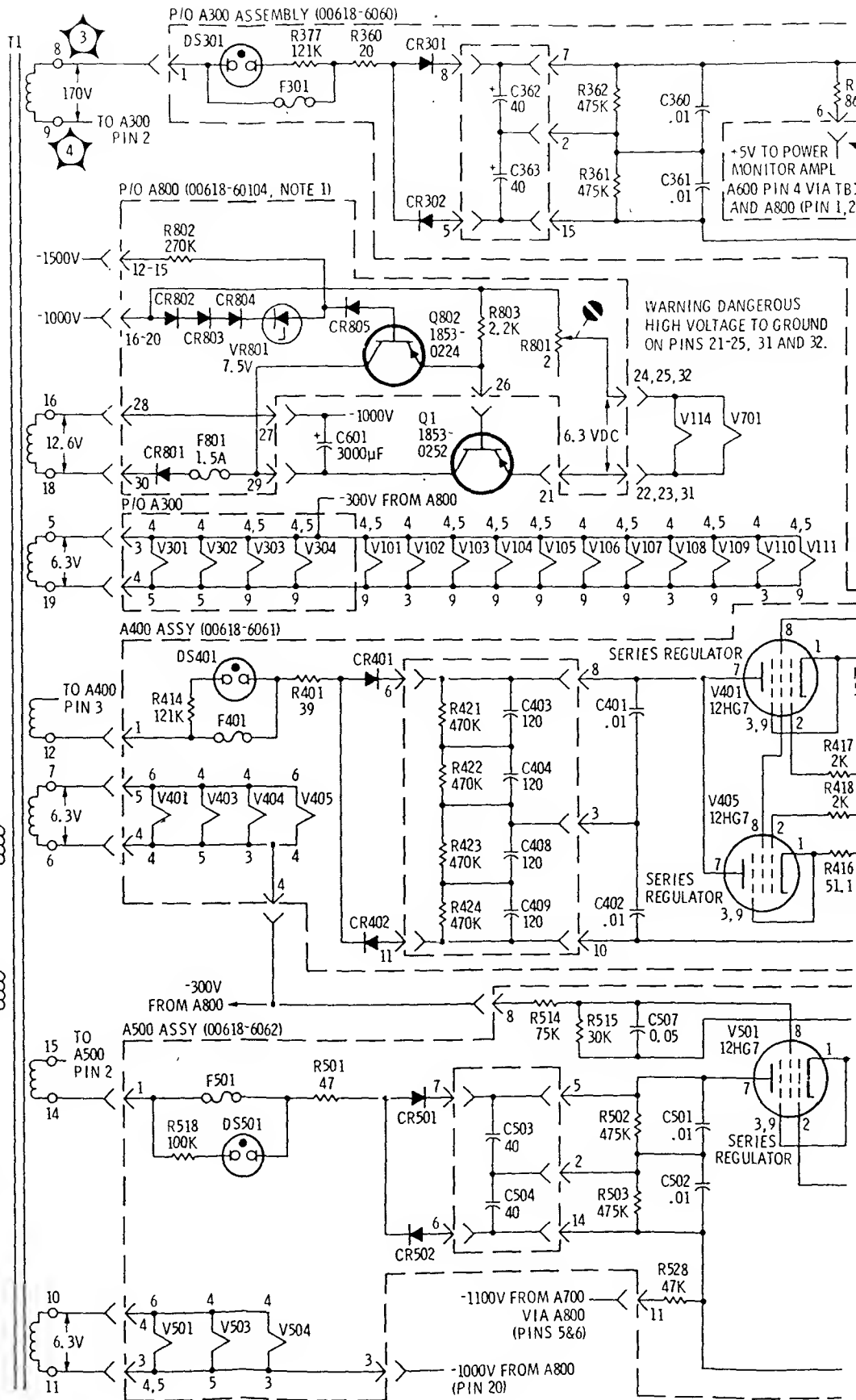
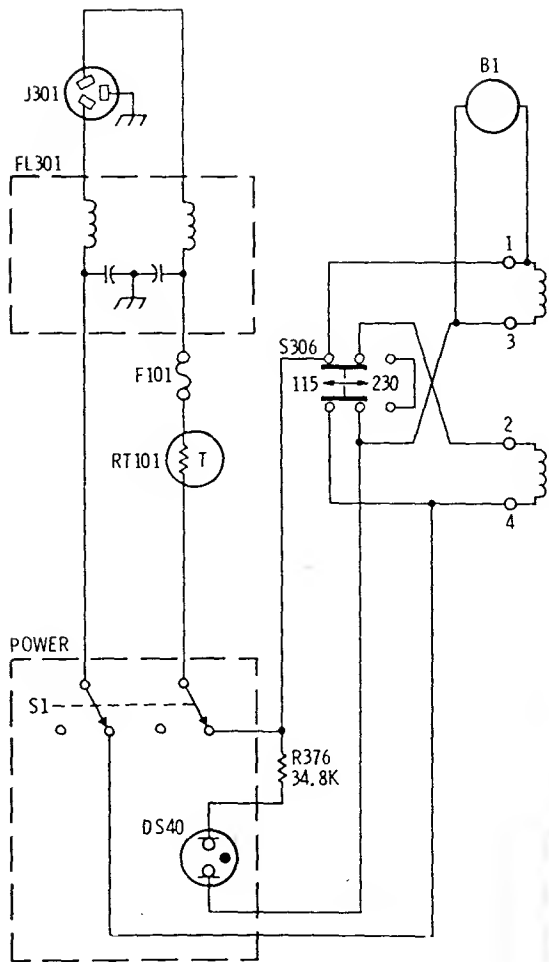
Component Identification, A400

CR801
F801
Q802
CR805
CR804
CR803
R803
VR801
R801
R802

Component Identification, A8



Component Identification, A900



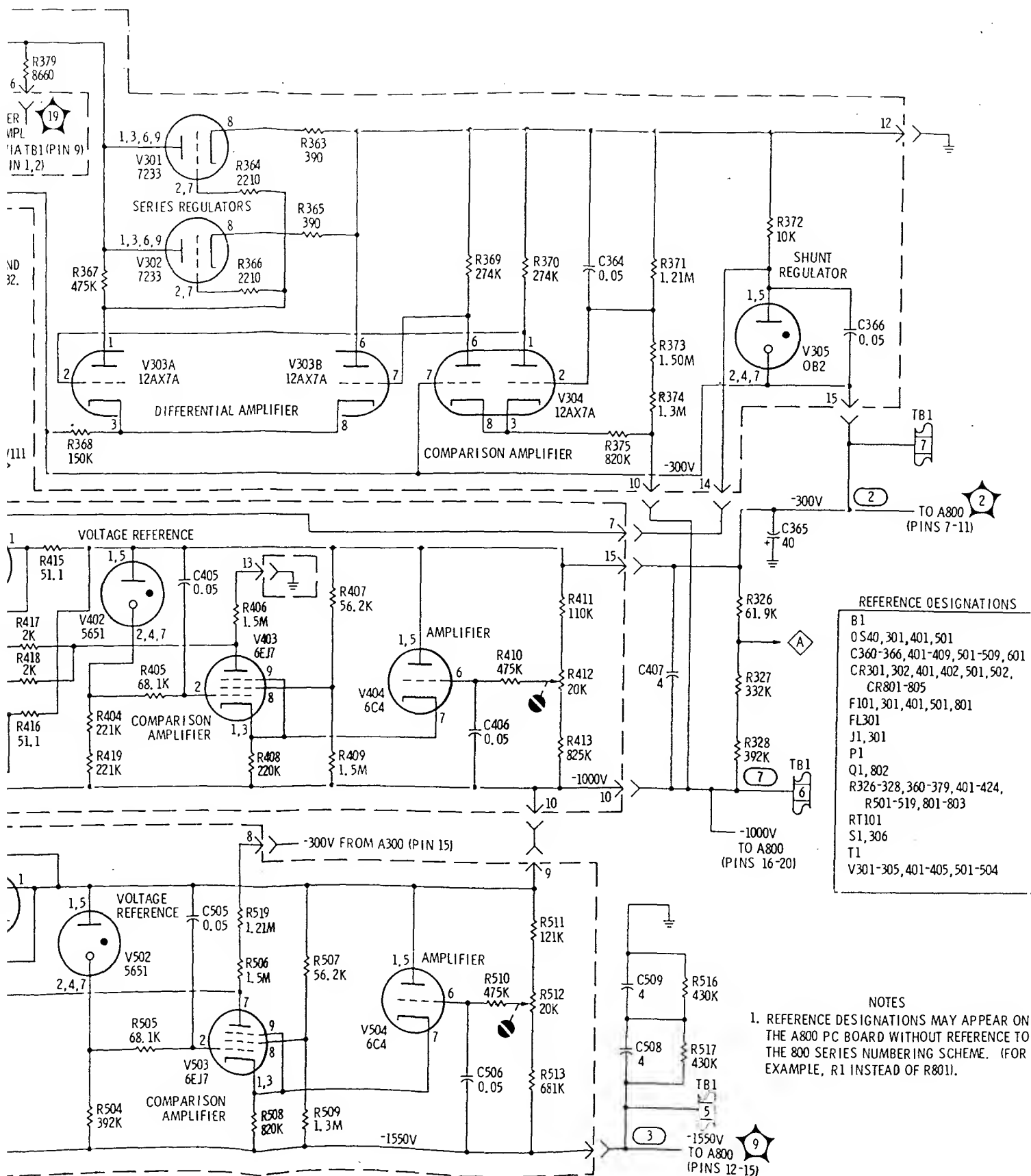


Figure 5-31. Power Supply Section

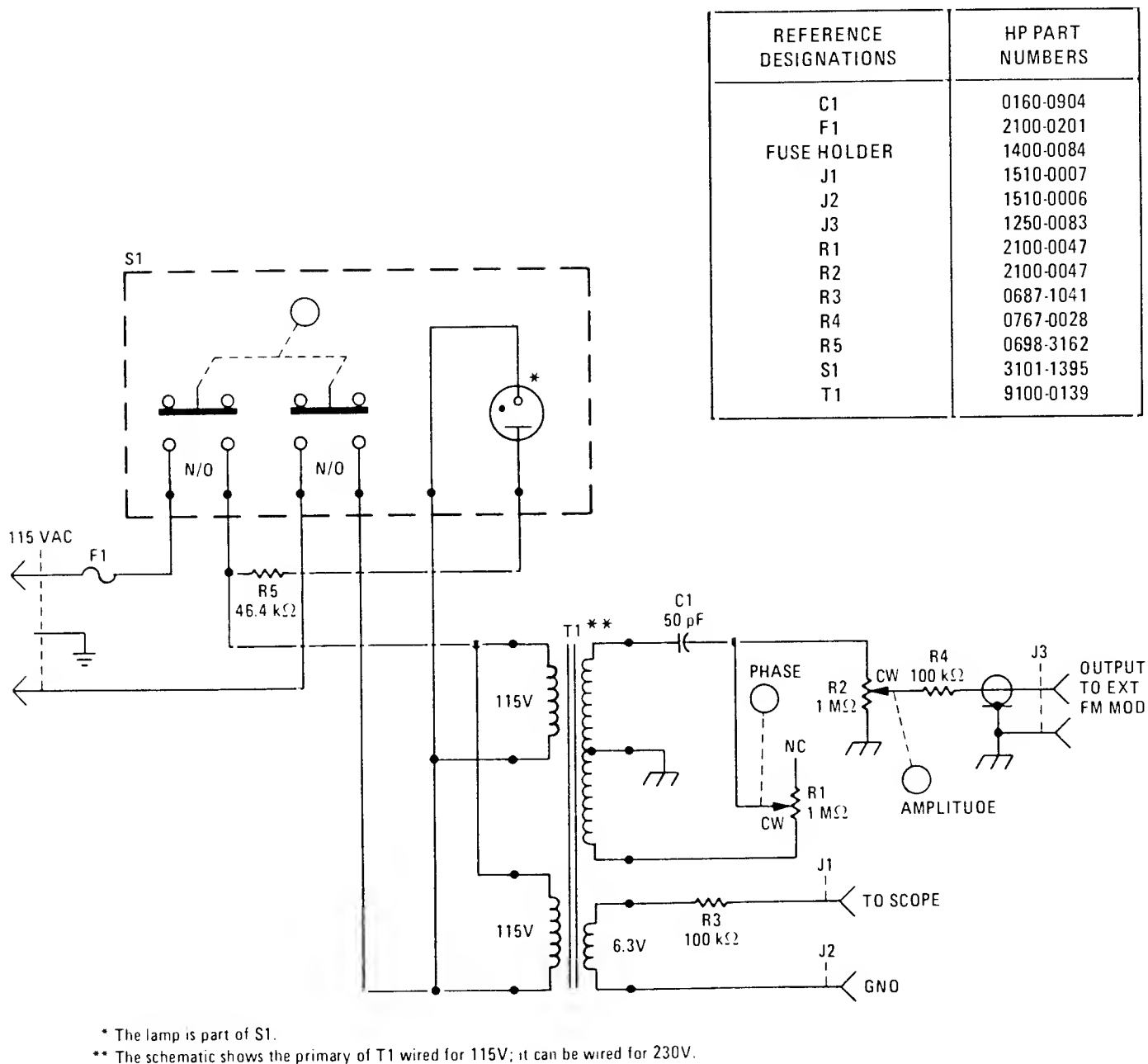


Figure 5-32. FM Modulator

SECTION VI

REPLACEABLE PARTS

6-1. INFORMATION.

6-2. This section contains information for ordering replaceable parts. Table 6-1 gives the meanings of abbreviations and reference designations used in the table of replaceable parts. Table 6-2 is the table of replaceable parts and is organized as follows:

- a. Electrical assemblies and their component parts in alpha-numerical order by reference designation.
- b. Chassis-mounted parts in alpha-numerical order by reference designation.
- c. Miscellaneous parts.

6-3. The information given for each part consists of:

- a. The Hewlett-Packard part number.
- b. Total quantity in the instrument.
- c. Description of the part.
- d. Typical manufacturer of the part in a 5-digit code.
- e. The manufacturer's number for the part.

Total quantity for each part is given only once - at the first appearance of the part number.

6-4. Table 6-3 contains the names and addresses that correspond to the manufacturer's code numbers.

6-3. ORDERING INFORMATION.

6-6. To order a replacement part, address order or inquiry to your local Hewlett-Packard sales and service office (see lists at rear of this manual).

6-7. Specify the following information for each part:

- a. Model and complete serial number of instrument.
- b. Hewlett-Packard part number.
- c. Circuit reference designation.
- d. Complete description of part.

Table 6-1. Reference Designations and Abbreviations

REFERENCE DESIGNATORS

| | | | | | | | |
|----|---------------------------|----|-------------------|----|----------------------|----|---|
| A | = assembly | F | = fuse | P | = plug | V | = vacuum tube, neon bulb, photocell, etc. |
| B | = motor | FL | = Filter | Q | = transistor | | |
| BT | = battery | J | = jack | R | = resistor | VR | = voltage regulator |
| C | = capacitor | K | = relay | RT | = thermistor | W | = cable |
| CP | = coupler | L | = inductor | S | = switch | X | = socket |
| CR | = diode | LS | = loud speaker | T | = transformer | Y | = crystal |
| DL | = delay line | M | = meter | TB | = terminal board | Z | = tuned cavity, network |
| DS | = device signaling (lamp) | MK | = microphone | TP | = test point | | |
| E | = misc electronic part | MP | = mechanical part | U | = integrated circuit | | |

ABBREVIATIONS

| | | | | | | | |
|-------|-------------------------------|---------|-----------------------|--------|---|---------|---------------------------|
| A | = amperes | H | = henries | N/O | = normally open | RMO | = rack mount only |
| AFC | = automatic frequency control | HDW | = hardware | NOM | = nominal | RMS | = root-mean square |
| AMPL | = amplifier | HEX | = hexagonal | NPO | = negative positive zero (zero temperature coefficient) | RWV | = reverse working voltage |
| BFO | = beat frequency oscillator | HG | = mercury | | | S-B | = slow-blow |
| BE CU | = beryllium copper | HR | = hour(s) | NPN | = negative-positive-negative | SCR | = screw |
| BH | = binder head | Hz | = Hertz | | | SE | = selenium |
| BP | = bandpass | IF | = intermediate freq | NRFR | = not recommended for field replacement | SECT | = section(s) |
| BRS | = brass | IMPG | = impregnated | | | SEMICON | = semiconductor |
| BWO | = backward wave oscillator | INCD | = incandescent | NSR | = not separately replaceable | SI | = silicon |
| | | INCL | = include(s) | | | SIL | = silver |
| | | INS | = insulation(ed) | OBD | = order by description | SL | = slide |
| | | INT | = internal | OH | = oval head | SPG | = spring |
| | | | | OX | = oxide | SPL | = special |
| CCW | = counterclockwise | K | = kilo = 1000 | P | = peak | SST | = Stainless steel |
| CER | = ceramic | LH | = left hand | PC | = printed circuit | SR | = split ring |
| CMO | = cabinet mount only | LIN | = linear taper | PF | = picofarads = 10^{-12} farads | STL | = steel |
| COEF | = coefficient | LK WASH | = lock washer | PH BRZ | = phosphor bronze | TA | = tantalum |
| COM | = common | LOG | = logarithmic taper | PHL | = Phillips | TD | = time delay |
| COMP | = composition | LPF | = low pass filter | PIV | = peak inverse voltage | TGL | = toggle |
| COMPL | = complete | | | PNP | = positive-negative-positive | THD | = thread |
| CONN | = connector | M | = milli = 10^{-3} | P/O | = part of | TI | = titanium |
| CP | = cadmium plate | MEG | = meg = 10^6 | POLY | = polystyrene | TOL | = tolerance |
| CRT | = cathode-ray tube | MET FLM | = metal film | PORC | = porcelain | TRIM | = trimmer |
| CW | = clockwise | MET OX | = metallic oxide | POS | = position(s) | TWT | = traveling wave tube |
| DEPC | = deposited carbon | MFR | = manufacturer | POT | = potentiometer | | |
| DR | = drive | MHz | = mega Hertz | PP | = peak-to-peak | | |
| LECT | = electrolytic | MINAT | = miniature | PT | = point | | |
| NCAP | = encapsulated | MOM | = momentary | PWV | = peak working voltage | | |
| EXT | = external | MOS | = metalized substrate | RECT | = rectifier | | |
| F | = farads | MTG | = mounting | RF | = radio frequency | | |
| FH | = flat head | MY | = "mylar" | RH | = round head or right hand | | |
| FIL H | = Filister head | N | = nano (10^{-9}) | | | | |
| FXD | = fixed | N/C | = normally closed | | | | |
| | | NE | = neon | | | | |
| G | = giga (10^9) | Ni PL | = nickel plate | | | | |
| GE | = germanium | | | | | | |
| GL | = glass | | | | | | |
| GRD | = ground(ed) | | | | | | |

Table 6-2. Replaceable Parts

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|---|----------|-------------------|
| A300 | 00618-6060 | 1 | BOARD ASSEMBLY, -300 VP8 | 28480 | 00618-6060 |
| C360 | 0150-0012 | 6 | CAPACITOR-PXO .01UF +-20% 1KVDC CER | 0420J | C023A102J103M838 |
| C361 | 0150-0012 | 4 | CAPACITOR-PXO .01UF +-20% 1KVDC CER | 0420J | C023A102J103M838 |
| C366 | 0150-0052 | 4 | CAPACITOR-PXO .05UF +-20% 400VDC CER | 28480 | 0150-0052 |
| CR301 | 1901-0029 | 3 | DIODE-PWR RECT 600V 750MA DO-29 | 0271C | MP494 |
| CR302 | 1901-0029 | 3 | DIODE-PWR RECT 600V 750MA DO-29 | 0271C | MP494 |
| DB301 | 2140-0047 | 3 | LAMP-GLOW A1C 135/105VDC 800UA T-2-BULB | 74276 | A1C |
| F301 | 2110-0008 | 2 | FUSE .5A 125V 8LO-8LO 1.25X.25 UL | 0470C | 313,500 |
| | 1400-0008 | 3 | FUSEHOLDER-BLOCK 15A 250V 1-FU | 28480 | 1400-0008 |
| R360 | 0613-0040 | 1 | RESISTOR 20 5% 5W PW TC0+-20 | 05520 | R8-5 |
| R361 | 0757-0789 | 5 | RESISTOR 475K 1% .25W F TC0+-100 | 03418 | C5-1/4-70-4753-F |
| R362 | 0757-0789 | 1 | RESISTOR 475K 1% .25W F TC0+-100 | 03418 | C5-1/4-70-4753-F |
| R363 | 0690-3911 | 2 | RESISTOR 390 10% 1W CC TC0+-529 | 01606 | GB3911 |
| R364 | 0757-0798 | 2 | RESISTOR 2.21K 1% .25W F TC0+-100 | 03418 | C5-1/4-70-2211-F |
| R365 | 0690-3911 | 1 | RESISTOR 390 10% 1W CC TC0+-529 | 01606 | GB3911 |
| R366 | 0757-0790 | 1 | RESISTOR 2.21K 1% .25W F TC0+-100 | 03418 | C5-1/4-70-2211-F |
| R367 | 0757-0789 | 1 | RESISTOR 475K 1% .25W F TC0+-100 | 03418 | C5-1/4-70-4753-F |
| R368 | 0757-0352 | 2 | RESISTOR 150K 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-1503-F |
| R369 | 0757-0131 | 2 | RESISTOR 274K 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-2743-F |
| R370 | 0757-0131 | 1 | RESISTOR 274K 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-2743-F |
| R371 | 0757-0871 | 2 | RESISTOR 1.21M 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-1214-F |
| R372 | 0611-0007 | 1 | RESISTOR 10K 1% 5W PW TC0+-20 | 05520 | R8-5 |
| R373 | 0757-0156 | 4 | RESISTOR 1.5M 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-1504-F |
| R374 | 0757-0472 | 2 | RESISTOR 1.3M 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-1304-F |
| R375 | 0690-8241 | 1 | RESISTOR 820K 10% 1W CC TC0+-882 | 01606 | GB8241 |
| R377 | 0757-0777 | 3 | RESISTOR 121K 1% .25W F TC0+-100 | 03418 | C5-1/4-70-1213-F |
| R379 | 0612-0038 | 1 | RESISTOR 8.66K 3% 5W PW TC0+-20 | 05520 | R8-5 |
| V301 | 1921-0014 | 2 | TUBE-ELECTRON 7233 TRIODE | 33173 | 7233 |
| V302 | 1921-0014 | 2 | TUBE-ELECTRON 7233 TRIODE | 33173 | 7233 |
| V303 | 1932-0030 | 2 | TUBE-ELECTRON 12AX7A TRIODE-EQUAL | 33173 | 12AX7A |
| V304 | 1932-0030 | 2 | TUBE-ELECTRON 12AX7A TRIODE-EQUAL | 33173 | 12AX7A |
| V305 | 1940-0007 | 1 | TUBE-ELECTRON 082 DIODE-V RGLTR | 0599A | 082 |
| A400 | 00618-6061 | 1 | BOARD ASSEMBLY, -1000 VP8 | 28480 | 00618-6061 |
| C401 | 0150-0012 | 2 | CAPACITOR-PXO .01UF +-20% 1KVDC CER | 0420J | C023A102J103M838 |
| C402 | 0150-0012 | 2 | CAPACITOR-PXO .01UF +-20% 1KVDC CER | 0420J | C023A102J103M838 |
| C405 | 0150-0052 | 2 | CAPACITOR-PXO .05UF +-20% 400VDC CER | 28480 | 0150-0052 |
| C406 | 0160-0904 | 2 | CAPACITOR-PXO .05UF +-20% 1KVDC CER | 28480 | 0160-0904 |
| CR401 | 1901-0487 | 2 | DIODE-HV RECT 1.5KV 250MA DO-29 | 0203G | 8R 2016-2 |
| CR402 | 1901-0487 | 2 | DIODE-HV RECT 1.5KV 250MA DO-29 | 0203G | 8R 2016-2 |
| DB401 | 2140-0047 | 1 | LAMP-GLOW A1C 135/105VDC 800UA T-2-BULB | 74276 | A1C |
| F401 | 2110-0008 | 2 | FUSE .5A 125V 8LO-8LO 1.25X.25 UL | 0470C | 313,500 |
| | 1400-0008 | 3 | FUSEHOLDER-BLOCK 15A 250V 1-FU | 28480 | 1400-0008 |
| R401 | 0693-3901 | 1 | RESISTOR 39 10% 2W CC TC0+-412 | 01606 | HB3901 |
| R404 | 0757-0862 | 3 | RESISTOR 221K 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-2213-F |
| R405 | 0757-0772 | 2 | RESISTOR 68.1K 1% .25W F TC0+-100 | 03418 | C5-1/4-70-6812-F |
| R406 | 0757-0156 | 1 | RESISTOR 1.5M 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-1504-F |
| R407 | 0757-0854 | 2 | RESISTOR 56.2K 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-5622-F |
| R408 | 0693-2241 | 1 | RESISTOR 220K 10% 2W CC TC0+-882 | 01606 | HB2241 |
| R409 | 0757-0156 | 1 | RESISTOR 1.5M 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-1504-F |
| R410 | 0757-0789 | 1 | RESISTOR 475K 1% .25W F TC0+-100 | 03418 | C5-1/4-70-4753-F |
| R411 | 0757-0859 | 1 | RESISTOR 110K 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-1103-F |
| R412 | 2100-1762 | 2 | RESISTOR-TRMR 20K 5% 1W B10E-A0J 1-TRN | 03740 | 3345N-H50-203 |
| R413 | 0757-0870 | 2 | RESISTOR 825K 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-8253-F |
| R414 | 0757-0777 | 1 | RESISTOR 121K 1% .25W F TC0+-100 | 03418 | C5-1/4-70-1213-F |
| R415 | 0757-1000 | 2 | RESISTOR 51.1 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-51R1-F |
| R416 | 0757-1000 | 1 | RESISTOR 51.1 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-51R1-F |
| R417 | 0757-0283 | 2 | RESISTOR 2K 1% .125W F TC0+-100 | 03298 | C4-1/8-70-2001-F |
| R418 | 0757-0283 | 1 | RESISTOR 2K 1% .125W F TC0+-100 | 03298 | C4-1/8-70-2001-F |
| R419 | 0757-0862 | 1 | RESISTOR 221K 1% .5W F TC0+-100 | 0299E | MF7C1/2-T0-2213-F |
| V401 | 1923-0071 | 3 | TUBE-ELECTRON 12MG7 PENTODE | 33173 | 12MG7 |
| V402 | 1940-0001 | 2 | TUBE-ELECTRON 5651A DIODE-V RGLTR | 14830 | 5651A |
| V403 | 1923-0046 | 2 | TUBE-ELECTRON 6EJ7 PENTODE | 04571 | 6EJ7(EF184) |
| V404 | 1921-0005 | 2 | TUBE-ELECTRON 6CA TRIODE | 33173 | 6CA |
| V405 | 1923-0071 | 2 | TUBE-ELECTRON 12MG7 PENTODE | 33173 | 12MG7 |

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|---|----------|-------------------|
| AS00 | 00618-6062 | 1 | BOARD ASSEMBLY, -1550 VPS | 28480 | 00618-6062 |
| CS01 | 0150-0012 | | CAPACITOR-PXO .01UF +-20% 1KVOC CER | 0420J | C023A102J103M838 |
| CS02 | 0150-0012 | | CAPACITOR-PXO .01UF +-20% 1KVOC CER | 0420J | C023A102J103M838 |
| CS03 | 0150-0052 | | CAPACITOR-PXO .05UF +-20% 400VOC CER | 28480 | 0150-0052 |
| CS06 | 0160-0904 | | CAPACITOR-PXO .05UF +-20% 1KVOC CER | 28480 | 0160-0904 |
| CS07 | 0150-0052 | | CAPACITOR-PXO .05UF +-20% 400VOC CER | 28480 | 0150-0052 |
| CA501 | 1901-0036 | 4 | DIODE-MV RECT 1KV 600MA 00-29 | 0271C | MP496 |
| CA502 | 1901-0036 | | DIODE-MV RECT 1KV 600MA 00-29 | 0271C | MP496 |
| OS01 | 2140-0047 | | LAMP-GLOW A1C 135/105VOC 800UA T-2-8UL8 | 74276 | A1C |
| ES01 | 9170-0029 | 3 | CORE-SHIELDING BEAD | 0188G | 56-590-65A2/4A |
| ES02 | 9170-0029 | | CORE-SHIELDING BEAD | 0188G | 56-590-65A2/4A |
| FS01 | 2110-0012 | 1 | FUSE .5A 250V FAST-BLO 1.25X.25 UL IEC | 0470C | 312.500 |
| | 1400-0008 | | FUSEMOLDER-BLOCK 15A 250V 1-FU | 28480 | 1400-0008 |
| RS01 | 0693-4701 | 1 | RESISTOR 47 10% 2W CC TC00+-12 | 0160G | M84701 |
| RS02 | 0757-0374 | 2 | RESISTOR 475K 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-4753-F |
| RS03 | 0757-0374 | | RESISTOR 475K 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-4753-F |
| RS04 | 0757-0313 | 2 | RESISTOR 392K 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-3923-F |
| RS05 | 0757-0772 | | RESISTOR 68.1K 1% .25W F TC00+-100 | 03418 | CS-1/4-T0-6812-F |
| RS06 | 0757-0156 | | RESISTOR 1.5M 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-1504-F |
| RS07 | 0757-0654 | | RESISTOR 56.2K 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-5622-F |
| RS08 | 0730-0101 | 1 | RESISTOR 820K 1% 1W CF TC00-500 | 05520 | OC1-8203-F |
| RS09 | 0757-0872 | | RESISTOR 1.3M 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-1304-F |
| RS10 | 0757-0784 | | RESISTOR 475K 1% .25W F TC00+-100 | 03418 | CS-1/4-T0-4753-F |
| RS11 | 0757-0777 | | RESISTOR 121K 1% .25W F TC00+-100 | 03418 | CS-1/4-T0-1213-F |
| RS12 | 2100-1762 | | RESISTOR-TMR 20K 5% HW 810E-ADJ 1-TRN | 03740 | 3345H-N50-203 |
| RS13 | 0757-0792 | 1 | RESISTOR 681K 1% .25W F TC00+-100 | 03418 | CS-1/4-T0-6813-F |
| RS14 | 0777-0002 | 2 | RESISTOR 75K 10% 7W MO TC00+-250 | 03418 | PF7-7-250-7502-K |
| RS15 | 0771-0007 | 1 | RESISTOR 30K 10% 4W MO TC00+-250 | 03418 | PF4-4-250-3002-K |
| RS16 | 0757-0367 | 1 | RESISTOR 100K 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-1003-F |
| RS19 | 0757-0871 | | RESISTOR 1.21M 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-1214-F |
| RS26 | 0696-6303 | 1 | RESISTOR 47K 10% 7W MO TC00+-250 | 03418 | PF7-7-250-4702-K |
| VS01 | 1923-0071 | | TUBE-ELECTRON 12HG7 PENTODE | 33173 | 12HG7 |
| VS02 | 1940-0001 | | TUBE-ELECTRON 5651A DIODE-V RGLTR | 14850 | 5651A |
| VS03 | 1923-0046 | | TUBE-ELECTRON 6EJ7 PENTODE | 04571 | 6EJ7 (EF184) |
| VS04 | 1921-0005 | | TUBE-ELECTRON 6C6 TRIODE | 33173 | 6C6 |
| AS00 | 00618-632 | 1 | BOARD ASSEMBLY, POWER MONITOR AMPLIFIER | 28480 | 00618-632 |
| CR601 | 1902-0041 | 1 | DIODE-ZNR 5.11V 5% 00-7 POW.4W TC00+-009% | 02038 | 82 10939-98 |
| CR602 | 1901-0025 | 1 | DIODE-GEN FRF 100V 200MA 00-7 | 28480 | 1901-0025 |
| Q601 | 1854-0221 | 2 | TRANSISTOR-DUAL NPN F04750MH | 28480 | 1854-0221 |
| Q602 | 1854-0221 | | TRANSISTOR-DUAL NPN F04750MH | 28480 | 1854-0221 |
| Q603 | 1854-0003 | 1 | TRANSISTOR NPN 81 T0-39 POW.800MH | 28480 | 1854-0003 |
| R603 | 0757-0427 | 1 | RESISTOR 1.5K 1% .125W F TC00+-100 | 03298 | C4-1/8-T0-1501-F |
| R604 | 0757-0437 | 2 | RESISTOR 4.75K 1% .125W F TC00+-100 | 03298 | C4-1/8-T0-4751-F |
| R605 | 0757-0437 | | RESISTOR 4.75K 1% .125W F TC00+-100 | 03298 | C4-1/8-T0-4751-F |
| R606 | 0757-0439 | 1 | RESISTOR 6.81K 1% .125W F TC00+-100 | 03298 | C4-1/8-T0-6811-F |
| R607 | 0757-0451 | 1 | RESISTOR 24.3K 1% .125W F TC00+-100 | 03298 | C4-1/8-T0-2432-F |
| R608 | 0757-0352 | | RESISTOR 150K 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-1503-F |
| R609 | 0757-0449 | 1 | RESISTOR 20K 1% .125W F TC00+-100 | 03298 | C4-1/8-T0-2002-F |
| R610 | 0757-0862 | | RESISTOR 221K 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-2213-F |
| R611 | 0757-0861 | 1 | RESISTOR 130K 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-1303-F |
| R612 | 2100-1772 | 1 | RESISTOR-TMR 500 5% HW TOP-ADJ 1-TRN | 03740 | 3345F-N50-501 |
| A700 | 00618-6076 | 2 | BOARD ASSEMBLY, KLYSTRON MODULATOR(618C) | 28480 | 00618-6076 |
| A700 | 00618-6076 | | BOARD ASSEMBLY, KLYSTRON MODULATOR(620B) | 28480 | 00618-6076 |
| C701 | 0160-0265 | 2 | CAPACITOR-PXO .01UF +-20% 3KVOC CER | 28480 | 0160-0265 |
| CR701 | 1902-0201 | 1 | DIODE-ZNR 100V 5% POW.1.5W TC00+-094% | 02038 | 821521-344 |
| CR702 | 1901-0024 | 1 | DIODE-PWR RECT 200V 750MA 00-29 | 0271C | MP492 |
| CR703 | 1901-0519 | 1 | DIODE-SWITCHING 200V 50NS 00-34 | 28480 | 1901-0519 |
| R701 | 0757-0139 | 3 | RESISTOR 1.1M 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-1104-F |
| R702 | 0757-0863 | 1 | RESISTOR 243K 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-2433-F |
| R703 | 0771-0005 | 1 | RESISTOR 24K 10% 4W MO TC00+-250 | 03418 | PF4-4-250-2402-K |
| R705 | 0777-0002 | | RESISTOR 75K 10% 7W MO TC00+-250 | 03418 | PF7-7-250-7502-K |
| R706 | 2100-2154 | 2 | RESISTOR-TMR 10K 30% CC TOP-ADJ 1-TRN | 03740 | UPH-45 |
| R707 | 2100-2154 | | RESISTOR-TMR 10K 30% CC TOP-ADJ 1-TRN | 03740 | UPH-45 |
| R708 | 0757-0133 | 2 | RESISTOR 363K 1% .5W F TC00+-100 | 0299E | MF7C1/2-T0-3633-F |
| V701 | 1921-0041 | 1 | TUBE-ELECTRON 7895 TRIODE | 0192A | 7895 |
| | 1200-0086 | 1 | SOCKET-TUBE 5-CONT ES-65 OIP-BLOR | 04506 | 133-65-11-026 |
| AS00 | 00618-60104 | 1 | BOARD ASSEMBLY, 6.3V REGULATOR | 28480 | 00618-60104 |
| CR801 | 1901-0048 | 1 | DIODE-PWR RECT 400V 1.5A | 02038 | 8R1846-12 |
| CR802 | 1901-0050 | 2 | DIODE-SWITCHING 80V 200MA 2NS 00-7 | 28480 | 1901-0050 |
| CR803 | 1901-0050 | | DIODE-SWITCHING 80V 200MA 2NS 00-7 | 28480 | 1901-0050 |
| CR804 | 1901-0036 | | DIODE-MV RECT 1KV 600MA 00-29 | 0271C | MP496 |
| CR805 | 1901-0036 | | DIODE-MV RECT 1KV 600MA 00-29 | 0271C | MP496 |

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|--|----------|--------------------|
| F801 | 2110-0304 | 1 | FUSE 1.5A 250V SLO-BLD 1.25X.25 UL 12C | 0448J | MOX-1-1/2A |
| MP801 | 2110-0269 | 2 | FUSEMOLDER-CLIP TYPE .250-FUSE | 28480 | 2110-0269 |
| MP802 | 2110-0269 | | FUSEMOLDER-CLIP TYPE .250-FUSE | 28480 | 2110-0269 |
| Q801 | | | NOT ASSIGNED | | |
| Q802 | 1853-0224 | 1 | TRANSISTOR PNP 61 TD-39 PDB1N F7R15MM2 | 0192A | 2N5413 |
| R801 | 2100-0308 | 1 | RESISTOR-VAR CONTROL WM 2 10% LIN | 0246J | AW |
| R802 | 0690-2741 | 3 | RESISTOR 270K 10% 1W CC TC=0+882 | 0160G | G82741 |
| R803 | 0687-2221 | 1 | RESISTOR 2.2K 10% .5W CC TC=0+647 | 0160G | G82221 |
| VR801 | 1902-3129 | 1 | DIODE-ZNR 7.5V 2% DO-7 PDB,4W TC=0+05% | 0223G | FZ7446 |
| A900 | 00618-6077 | | BOARD ASSEMBLY, MODULATOR | 28480 | 00618-6077 |
| C115 | 0160-2120 | 8 | CAPACITOR-FXD .01UF +-1% 300VDC MICA0+70 | 28480 | 0160-2120 |
| C122 | 0160-2306 | 3 | CAPACITOR-FXD 27PF +-5% 300VDC | 28480 | 0160-2306 |
| C127 | 0140-0206 | | CAPACITOR-FXD 270PF +-5% 500VDC MICA | 72136 | DM15F271J0500WV1CR |
| C128 | 0160-2306 | | CAPACITOR-FXD 27PF +-5% 300VDC | 28480 | 0160-2306 |
| C129 | 0140-0206 | 5 | CAPACITOR-FXD 270PF +-5% 500VDC MICA *FACTORY SELECTED PART | 72136 | DM15F271J0500WV1CR |
| C130 | 0140-0162 | 1 | CAPACITOR-FXD 4700PF +-10% 300VDC MICA | 72136 | DM20F472K0300WV1CR |
| C131 | 0160-2120 | | CAPACITOR-FXD .01UF +-1% 300VDC MICA0+70 | 28480 | 0160-2120 |
| C132 | 0140-0206 | | CAPACITOR-FXD 270PF +-5% 500VDC MICA | 72136 | DM15F271J0500WV1CR |
| C138 | 0160-2204 | 4 | CAPACITOR-FXD 100PF +-5% 300VDC MICA0+70 | 28480 | 0160-2204 |
| C139 | 0160-0206 | | CAPACITOR-FXD 270PF +-5% 500VDC MICA | 72136 | DM15F271J0500WV1CR |
| C140 | 0160-2204 | | CAPACITOR-FXD 100PF +-5% 300VDC MICA0+70 | 28480 | 0160-2204 |
| CR101 | 1901-0029 | 1 | DIODE-PWR RECT 600V 750MA OD=29 | 0271C | MP894 |
| CR102 | 1901-0096 | 1 | DIODE-SWITCHING 120V 50MA 100N8 | 28480 | 1901-0096 |
| L101 | 618B-60A | 1 | COIL, RF .350 MH | 28480 | 618B-60A |
| R134 | 0690-3321 | 1 | RESISTOR 3.3K 10% 1W CC TC=0+647 *FACTORY SELECTED PART | 0160G | GB3321 |
| R144 | 0690-1221 | 5 | RESISTOR 1.2K 10% 1W CC TC=0+647 | 0160G | GB1221 |
| R145 | 0693-1031 | 5 | RESISTOR 10K 10% 1W CC TC=0+647 | 0160G | HB1031 |
| R146 | 0690-1541 | 3 | RESISTOR 150K 10% 1W CC TC=0+882 | 0160G | G81541 |
| R149 | 0690-2741 | | RESISTOR 270K 10% 1W CC TC=0+882 | 0160G | G82741 |
| R150 | 0690-5641 | 1 | RESISTOR 560K 10% 1W CC TC=0+882 | 0160G | G85641 |
| R151 | 0690-2221 | 3 | RESISTOR 2.2K 10% 1W CC TC=0+647 | 0160G | G82221 |
| R152 | 0690-2221 | | RESISTOR 2.2K 10% 1W CC TC=0+647 | 0160G | G82221 |
| R153 | 0690-4741 | | RESISTOR 470K 10% 1W CC TC=0+882 | 0160G | GB4741 |
| R154 | 0690-4741 | 5 | RESISTOR 470K 10% 1W CC TC=0+882 *FACTORY SELECTED PART | 0160G | GB4741 |
| R155 | 0690-4731 | | RESISTOR 47K 10% 1W CC TC=0+765 | 0160G | GB4731 |
| R157 | 0690-2221 | | RESISTOR 2.2K 10% 1W CC TC=0+647 | 0160G | G82221 |
| R160 | 0693-3331 | 4 | RESISTOR 33K 10% 2W CC TC=0+765 | 0160G | MB3331 |
| R161 | 0693-3331 | | RESISTOR 33K 10% 2W CC TC=0+765 | 0160G | MB3331 |
| R162 | 0690-1051 | 2 | RESISTOR 1M 10% 1W CC TC=0+1000 | 0160G | GB1051 |
| R186 | 0690-4731 | 8 | RESISTOR 47K 10% 1W CC TC=0+765 *FACTORY SELECTED PART | 0160G | GB4731 |
| R187 | 0690-4731 | | RESISTOR 47K 10% 1W CC TC=0+765 | 0160G | GB4731 |
| R188 | 0690-1041 | 5 | RESISTOR 100K 10% 1W CC TC=0+882 *FACTORY SELECTED PART | 0160G | GB1041 |
| R189 | 0690-4741 | | RESISTOR 470K 10% 1W CC TC=0+882 | 0160G | GB4741 |
| R190 | 0690-1541 | | RESISTOR 150K 10% 1W CC TC=0+882 | 0160G | GB1541 |
| R191 | 0690-1841 | 1 | RESISTOR 180K 10% 1W CC TC=0+882 | 0160G | GB1841 |
| R192 | 0690-4731 | | RESISTOR 47K 10% 1W CC TC=0+765 | 0160G | GB4731 |
| R193 | 0690-4721 | 2 | RESISTOR 4.7K 10% 1W CC TC=0+647 | 0160G | GB4721 |
| R194 | 0690-4731 | | RESISTOR 47K 10% 1W CC TC=0+765 | 0160G | GB4731 |
| R195 | 0690-6821 | 1 | RESISTOR 6.8K 10% 1W CC TC=0+647 | 0160G | GB6821 |
| R196 | 0693-3331 | | RESISTOR 33K 10% 2W CC TC=0+765 | 0160G | MB3331 |
| R197 | 0690-1251 | 7 | RESISTOR 1.2M 10% 1W CC TC=0+1000 | 0160G | GB1251 |
| R198 | 0690-1031 | 4 | RESISTOR 10K 10% 1W CC TC=0+765 | 0160G | GB1031 |
| R207 | 0690-5621 | 1 | RESISTOR 5.6K 10% 1W CC TC=0+647 | 0160G | GB5621 |
| R208 | 0690-8231 | 1 | RESISTOR 82K 10% 1W CC TC=0+765 | 0160G | GB8231 |
| R326 | 0757-0309 | 1 | RESISTOR 61.9K 1% .5W P TC=0+-100 | 0299E | MF7C1/2-T0-6192-F |
| R327 | 0757-0307 | 1 | RESISTOR 332K 1% .5W P TC=0+-100 | 0299E | MF7C1/2-T0-3323-F |
| R328 | 0757-0313 | 1 | RESISTOR 392K 1% .5W P TC=0+-100 | 0299E | MF7C1/2-T0-3923-F |
| #1000 | 00618-6078 | | BOARD ASSEMBLY, MODULATOR | 28480 | 00618-6078 |
| C102 | 0160-2120 | | CAPACITOR-FXD .01UF +-1% 300VDC MICA0+70 | 28480 | 0160-2120 |
| C103 | 0140-0149 | 1 | CAPACITOR-FXD 470PF +-5% 300VDC MICA *FACTORY SELECTED PART | 72136 | DM15F471J0300WV1CR |
| C104 | 0140-0197 | 1 | CAPACITOR-FXD 180PF +-5% 300VDC MICA0+70 *FACTORY SELECTED PART | 72136 | DM15F181J0300WV1CR |
| C105 | 0160-2218 | 3 | CAPACITOR-FXD 1000PF +-5% 300VDC | 28480 | 0160-2218 |
| C106 | 0160-2120 | | CAPACITOR-FXD .01UF +-1% 300VDC MICA0+70 | 28480 | 0160-2120 |
| C107 | 0160-2218 | | CAPACITOR-FXD 1000PF +-5% 300VDC | 28480 | 0160-2218 |
| C108 | 0160-3493 | 1 | CAPACITOR-FXD 2200PF +-5% 500VDC | 28480 | 0160-3493 |
| C109 | 0160-2218 | | CAPACITOR-FXD 1000PF +-5% 300VDC | 28480 | 0160-2218 |

See introduction to this section for ordering information

Table 6-2 Replaceable Parts

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|--|----------|----------------------|
| C110 | 0160-2120 | 1 | CAPACITOR-FXD .01UF +-1% 300VDC MICA0+70 | 2R4R0 | 0160-2120 |
| C111 | 0160-2204 | | CAPACITOR-FXD 100PF +-5% 300VDC MICA0+70 | 2R4R0 | 0160-2204 |
| C112 | 0140-0190 | | CAPACITOR-FXD 39PF +-5% 300VDC | 72136 | DM15E390J0300HV1CR |
| C113 | 0140-0209 | | CAPACITOR-FXD 8PF +-10% 300VDC | 72136 | DM15C080K0500HV1CR |
| C114 | 0140-0191 | 1 | CAPACITOR-FXD 56PF +-5% 300VDC | 72136 | DM15E560J0300HV1CR |
| C116 | 0160-2306 | 1 | CAPACITOR-FXD 27PF +-5% 300VDC | 2R4R0 | 0160-2306 |
| C117 | 0160-2204 | | CAPACITOR-FXD 100PF +-5% 300VDC MICA0+70 | 2R4R0 | 0160-2204 |
| C119 | 0140-0206 | | CAPACITOR-FXD 270PF +-5% 300VDC MICA | 72136 | DM15F271J0500HV1CR |
| C120 | 0150-0071 | | CAPACITOR-FXD 400PF +-5% 1KVDC CER | 2R4R0 | 0150-0071 |
| C121 | 0160-2120 | 1 | CAPACITOR-FXD .01UF +-1% 300VDC MICA0+70 | 2R4R0 | 0160-2120 |
| C124 | 0160-2120 | 1 | CAPACITOR-FXD .01UF +-1% 300VDC MICA0+70 | 2R4R0 | 0160-2120 |
| C125 | 0160-2120 | | CAPACITOR-FXD .01UF +-1% 300VDC MICA0+70 | 2R4R0 | 0160-2120 |
| C126 | 0140-0157 | | CAPACITOR-FXD 1R87PF +-1% 300VDC MICA | 72136 | DM20F1857RF0500HV1CR |
| C142 | 0160-0598 | 2 | CAPACITOR-FXD .25UF +-10% 1.5KVDC | 2R4R0 | 0160-0598 |
| R101 | 0690-1251 | 1 | RESISTOR 1.2M 10% 1W CC TC0+1000 | 0160G | GR1251 |
| R102 | 0690-1281 | | RESISTOR 1.2M 10% 1W CC TC0+1000 | 0160G | GR1281 |
| R103 | 0690-4731 | | RESISTOR 47K 10% 2W CC TC0+765 | 0160G | GR4731 |
| R104 | 0690-1251 | | RESISTOR 1.2M 10% 1W CC TC0+1000 | 0160G | GR1251 |
| R108 | 0690-4731 | 2 | RESISTOR 47K 10% 1W CC TC0+765 | 0160G | GR4731 |
| R106 | 0690-1041 | | RESISTOR 100K 10% 1W CC TC0+882 | 0160G | GR1041 |
| R107 | 0690-2731 | | RESISTOR 27K 10% 2W CC TC0+765 | 0160G | GR2731 |
| R108 | 0690-4741 | | RESISTOR 470K 10% 1W CC TC0+882 | 0160G | GR4741 |
| R109 | 0690-1041 | 1 | RESISTOR 100K 10% 1W CC TC0+882 | 0160G | GR1041 |
| R110 | 0690-4731 | | RESISTOR 47K 10% 1W CC TC0+765 | 0160G | GR4731 |
| R115 | 0690-1051 | 1 | RESISTOR 1M 10% 1W CC TC0+1000 | 0160G | GR1051 |
| R116 | 0690-6811 | | RESISTOR .680 10% 1W CC TC0+529 | 0160G | GR6811 |
| R118 | 0690-1831 | | RESISTOR 18K 10% 2W CC TC0+765 | 0160G | GR1831 |
| R119 | 0690-1031 | | RESISTOR 10K 10% 2W CC TC0+765 | 0160G | GR1031 |
| R120 | 0690-4721 | 1 | RESISTOR 4.7K 10% 1W CC TC0+647 | 0160G | GR4721 |
| R121 | 0690-2721 | | RESISTOR 2.7K 10% 1W CC TC0+647 | 0160G | GR2721 |
| R122 | 0690-2731 | | RESISTOR 27K 10% 2W CC TC0+765 | 0160G | GR2731 |
| R123 | 0690-4731 | | RESISTOR 47K 10% 1W CC TC0+765 | 0160G | GR4731 |
| R124 | 0690-1221 | 1 | RESISTOR 1.2K 10% 1W CC TC0+647 | 0160G | GR1221 |
| R125 | 0690-4741 | | RESISTOR 470K 10% 1W CC TC0+882 | 0160G | GR4741 |
| R126 | 0690-1031 | 1 | RESISTOR 10K 10% 1W CC TC0+765 | 0160G | GR1031 |
| R127 | 0690-1031 | | RESISTOR 10K 10% 1W CC TC0+765 | 0160G | GR1031 |
| R128 | 0690-1251 | | RESISTOR 1.2M 10% 1W CC TC0+1000 | 0160G | GR1251 |
| R129 | 0690-1031 | | RESISTOR 10K 10% 1W CC TC0+765 | 0160G | GR1031 |
| R130 | 0690-1221 | 1 | RESISTOR 1.2K 10% 1W CC TC0+647 | 0160G | GR1221 |
| R131 | 0690-2741 | | RESISTOR 270K 10% 1W CC TC0+882 | 0160G | GR2741 |
| R132 | 0690-1251 | | RESISTOR 1.2M 10% 1W CC TC0+1000 | 0160G | GR1251 |
| R133 | 0690-3331 | | RESISTOR 33K 10% 2W CC TC0+765 | 0160G | GR3331 |
| R137 | 0690-2711 | 1 | RESISTOR 270 10% 1W CC TC0+529 | 0160G | GR2711 |
| R138 | 0690-1031 | | RESISTOR 10K 10% 2W CC TC0+765 | 0160G | GR1031 |
| R139 | 0690-1031 | 1 | RESISTOR 10K 10% 2W CC TC0+765 | 0160G | GR1031 |
| R140 | 0690-1031 | | RESISTOR 10K 10% 2W CC TC0+765 | 0160G | GR1031 |
| R141 | 0690-1041 | | RESISTOR 100K 10% 1W CC TC0+882 | 0160G | GR1041 |
| R142 | 0690-1541 | | RESISTOR 150K 10% 1W CC TC0+882 | 0160G | GR1541 |
| R143 | 0690-1251 | 1 | RESISTOR 1.2M 10% 1W CC TC0+1000 | 0160G | GR1251 |
| R146 | 0690-1241 | | RESISTOR 120K 10% 1W CC TC0+882 | 0160G | GR1241 |
| R149 | 0690-1011 | | RESISTOR 100 10% 1W CC TC0+529 | 0160G | GR1011 |
| R149 | 0690-1221 | | RESISTOR 1.2K 10% 1W CC TC0+647 | 0160G | GR1221 |

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|--|----------|---------------------|
| CHASSIS PARTS | | | | | |
| B1 | 3140-0055 | 1 | MOTOR-AC IND SHADED-F 115V 3470-RPM | 58480 | 3140-0055 |
| C101 | 0160-0081 | 3 | CAPACITOR-FXD .55UF +-10% 1KVDC PFR | 0450J | CP5551E0554K |
| C118 | 0160-0090 | 1 | CAPACITOR-FXD .1UF +-10% 1KVDC PFR | 0450J | 90F114 |
| C183 | 0160-0081 | 1 | CAPACITOR-FXD .55UF +-10% 1KVDC PFR | 0450J | CP5551E0554K |
| C135 | 0160-0087 | 1 | CAPACITOR-FXD .5UF +-10% 600VDC PFR | 60656 | F30M7508K |
| C136 | 0160-0595 | 1 | CAPACITOR-FXD .55UF +-10% 1.5KVDC | 58480 | 0160-0595 |
| C137 | 0160-0089 | 1 | CAPACITOR-FXD .1UF/+.1UF +50-10% 1KVDC | 0450J | 90P156 |
| C141 | 0160-0081 | 1 | CAPACITOR-FXD .55UF +-10% 1KVDC PFR | 0450J | CP5551E0554K |
| C143 | 0170-0038 | 5 | CAPACITOR-FXD .85UF +-10% 800VDC POLYE | 58480 | 0170-0038 |
| C144 | 0180-0049 | 1 | CAPACITOR-FXD 50UF+75-10% 50VDC AL | 0488J | 300806050CC8 |
| C145 | 0170-0038 | 1 | CAPACITOR-FXD .88UF +-10% 800VDC POLYE | 58480 | 0170-0038 |
| C368 | 0150-0054 | 5 | CAPACITOR-FXD 40UF+50-10% 450VDC AL | 55450 | 0150-0054 |
| C363 | 0160-0054 | 1 | CAPACITOR-FXD 40UF+50-10% 450VDC AL | 55480 | 0160-0054 |
| C365 | 0180-0084 | 1 | CAPACITOR-FXD 40UF+50-10% 450VDC AL | 58480 | 0180-0084 |
| C403 | 0180-0048 | 4 | CAPACITOR-FXD 120UF+75-10% 350VDC AL | 58480 | 0180-0048 |
| C404 | 0180-0048 | 1 | CAPACITOR-FXD 120UF+75-10% 350VDC AL | 58480 | 0180-0048 |
| C407 | 0160-0675 | 3 | CAPACITOR-FXD 4UF +-10% 1KVDC MET-POLYE | 58480 | 0160-0675 |
| C408 | 0150-0045 | 1 | CAPACITOR-FXD 150UF+75-10% 350VDC AL | 58480 | 0150-0045 |
| C409 | 0180-0045 | 1 | CAPACITOR-FXD 180UF+75-10% 350VDC AL | 28480 | 0180-0045 |
| C503 | 0180-0054 | 1 | CAPACITOR-FXD 40UF+50-10% 450VDC AL | 58480 | 0180-0054 |
| C504 | 0180-0054 | 1 | CAPACITOR-FXD 40UF+50-10% 450VDC AL | 58480 | 0180-0054 |
| C508 | 0160-0675 | 1 | CAPACITOR-FXD 4UF +-10% 1KVDC MET-POLYE | 28480 | 0160-0675 |
| C509 | 0160-0675 | 1 | CAPACITOR-FXD 4UF +-10% 1KVDC MET-POLYE | 25480 | 0160-0675 |
| C601 | 0180-0188 | 1 | CAPACITOR-FXD 2800UF+50-10% 30VDC AL | 58480 | 0180-0188 |
| C705 | 0160-0565 | 1 | CAPACITOR-FXD .01UF +-50% 3KVDC CER | 55450 | 0160-0565 |
| CR103 | 1901-0030 | 1 | DIODE-PWR RECT 800V 600MA DO-59 | 0571C | MF495 |
| CR603 | 00418-658 | 1 | DETECTOR ASSEMBLY, 80LDMETER | 58450 | 00418-658 |
| D840 | 5140-0844 | 1 | LAMP-GLOW A1M 135/105VDC 1.5MA T-S-SULB | 58480 | 2140-0544 |
| F101 | 5110-0059 | 1 | FUSE 3A 250V SLO-SLO 1.55X.55 UL | 0470C | 333083 |
| F101 | 5110-0338 | 1 | FUSE 1.6A 550V SLO-SLO 1.55X.55 UL IEC | 0448J | MOX 1-6/10 |
| | 2110-0470 | 1 | FUSEMOLDER-EXTR POST 50A 300V UL/IEC | 0470C | 345003-010 |
| | 1400-0090 | 1 | WASHER-RUBBER 5/8" OD | 0000J | 080 |
| | 5110-0465 | 1 | FUSEMOLDER-EXTR POST UL/IEC .25X1.55FUSE | 58480 | 5110-0465 |
| | 5110-0467 | 1 | NUT, HEX SINGLE CHAMFER 1/5-28 THREAD | 7591E | 903-070 |
| FL301 | 9100-3145 | 1 | FILTER, RFI | 55480 | 9100-3145 |
| J101 | 6158-167 | 1 | CABLE, SYNC IN | 28480 | 6158-167 |
| J108 | 6158-16U | 1 | CABLE, SYNC OUT | 58480 | 6158-16U |
| J103 | 6155-168 | 1 | CABLE, EXT MOD | 58480 | 6155-168 |
| J104 | 6158-16V | 1 | CABLE, DELAYED SYNC OUT | 58480 | 6158-16V |
| J105 | 1550-0144 | 5 | CONNECTOR-RF N FEM SGL HOLE FR | 55480 | 1550-0144 |
| J106 | 1550-0144 | 1 | CONNECTOR-RF N FEM SGL HOLE FR | 28480 | 1550-0144 |
| J301 | 1851-0148 | 1 | CONNECTOR-AC PWR MF-8 MALE FLG-M76 | 0505G | AC3G |
| J303 | 1851-1036 | 1 | CONNECTOR 7-PIN F HEXAGONAL | 0500B | M76 |
| L108 | 9170-0089 | 1 | CORE-SHIELDING BEAD | 0188G | 56-590-65A2/4A |
| M101 | 1150-1577 | 1 | METER10-181 MA | 88480 | 1120-1577 |
| P308 | 1551-0194 | 1 | CONNECTOR-PC EDGE 15-CON7/ROW 1-ROW | 0339D | 91-6915-1113-00 |
| Q1 | 1853-0558 | 1 | TRANSISTOR FNP 81 70-3 F06150M FT-AMMZ | 55480 | 1853-0558 |
| R111 | 5100-0059 | 1 | RESVAR COMP 3X1 MEGOHM 10% LIN 5W | 58480 | 2100-0059 |
| R115 | 5100-0029 | 5 | RESISTOR-VAR CONTROL CC 550K 10% LIN | 05585 | 380 |
| R113 | 5100-0029 | 1 | RESISTOR-VAR CONTROL CC 550K 10% LIN | 05588 | 380 |
| R114 | | | N.S.R. PART OF R111 | | |
| R117 | 5100-0055 | 3 | RESISTOR-VAR CONTROL CC 1.5K 10% LIN | 05588 | 380CS-5-1/4W-1501-K |
| R133 | 5100-0085 | 1 | RESISTOR-VAR CONTROL CC 1.5K 10% LIN | 05585 | 380CS-5-1/4W-1501-K |
| R136 | 5100-0047 | 5 | RESISTOR-VAR CONTROL CC 1M 50% 10CM | 05588 | 380 |
| R147 | | | N.S.R. PART OF R111 AND R112 | | |
| R156 | 5100-0055 | 1 | RESISTOR-VAR CONTROL CC 1.5K 10% LIN | 05588 | 380CS-5-1/4W-1501-K |
| R158 | 5100-0051 | 1 | RESISTOR-VAR CONTROL CC 50K 10% 10CM | 05588 | 380 |
| R168 | 2180-0047 | 1 | RESISTOR-VAR CONTROL CC 1M 50% 10CM | 02588 | 380 |
| R169 | 0490-1041 | 1 | RESISTOR 100K 10% 1W CC TC=0+885 | 0160G | 051041 |
| R170 | 5100-0058 | 4 | RESISTOR-VAR CONTROL CC 50K 10% LIN | 05585 | 380 |
| R171 | 0493-1531 | 1 | RESISTOR 15K 10% 5W CC TC=0+765 | 0160G | M81531 |
| R178 | 0493-8831 | 1 | RESISTOR 88K 10% 5W CC TC=0+765 | 0160G | M88531 |
| R173 | 5100-0058 | 1 | RESISTOR-VAR CONTROL CC 50K 10% LIN | 05585 | 380 |
| R174 | 5100-0157 | 1 | RESVAR 100K OHM 10% 5W | 88480 | 2100-0187 |
| R175 | 5100-0058 | 1 | RESISTOR-VAR CONTROL CC 50K 10% LIN | 05588 | 380 |
| R176 | 0493-4781 | 2 | RESISTOR 4.7K 10% 5W CC TC=0+647 | 0160G | M84781 |
| R177 | 0493-4781 | 1 | RESISTOR 4.7K 10% 5W CC TC=0+647 | 0160G | M84781 |

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|--|----------|---------------------|
| R178 | 8100-0028 | 1 | RESISTOR-VAR CONTROL CC 50K 10% LIN | 08588 | 380 |
| R204 | 0687-1011 | | RESISTOR 100 10% .8W CC TC00+829 | 0160G | E81011 |
| R205 | 0690-1281 | | RESISTOR 1.8K 10% 1W CC TC00+847 | 0160G | G81881 |
| R209 | 0787-0818 | | RESISTOR 562 1% .5W F TC00+100 | 0899E | MF7C1/2-70-862R-F |
| R211 | 8687-2861 | | RESISTOR 22M 10% .8W CC TC00+1089 | 0160G | E88261 |
| R376 | 0787-0183 | 4 | RESISTOR 3A,8K 1% .188W F TC00+100 | 0160G | CC |
| R421 | 0687-4741 | | RESISTOR 870K 10% .8W CC TC00+882 | 0160G | E84741 |
| R482 | 0687-4741 | | RESISTOR 470K 10% .8W CC TC00+888 | 0160G | E84741 |
| R483 | 0687-4741 | | RESISTOR 470K 10% .8W CC TC00+888 | 0160G | E84741 |
| R484 | 0687-4741 | | RESISTOR 470K 10% .8W CC TC00+882 | 0160G | E84741 |
| R816 | 0761-0099 | 2 | RESISTOR 430K 8% 1W MO TC00+200 | 03418 | FP-38 |
| R817 | 0761-0099 | | RESISTOR 430K 5% 1W MO TC00+800 | 03418 | FP-32 |
| R880 | 0757-0870 | | RESISTOR 828K 1% .5W F TC00+100 | 0899E | MF7C1/8-T0-8883-F |
| R881 | 0787-0139 | | RESISTOR 1.1M 1% .5W F TC00+100 | 0899E | MF7C1/8-T0-1104-F |
| R882 | 0757-0139 | | RESISTOR 1.1M 1% .8W F TC00+100 | 0899E | MF7C1/8-T0-1104-F |
| R883 | 8100-0468 | 1 | RESISTOR-VAR CONTROL CC 1M 80% LIN | 08888 | 380 |
| R884 | 0787-0133 | | RESISTOR 383K 1% .8W F TC00+100 | 0899E | MF7C1/2-70-3833-F |
| R888 | 0757-0089 | | RESISTOR 1M 1% .5W F TC00+100 | 0899E | MF7C1/8-T0-1004-F |
| R886 | 0757-0059 | | RESISTOR 1M 1% .5W F TC00+100 | 0899E | MF7C1/8-T0-1004-F |
| R887 | 0698-3260 | | RESISTOR 444K 1% .188W F TC00+100 | 0160G | CC |
| RT101 | 0839-0006 | 1 | FACTORY SELECTED PART THERMISTOR DISC 10-OMH 7C4-3,8% C-DE8 | 28480 | 0839-0006 |
| S1 | 3101-1398 | 1 | SWITCH-PS DPDT-DB ALYNG 10,5A 880VAC | 0100H | 83-67880-181/A1M |
| S101 | 6188-198 | | SWITCH ASSEMBLY, MOD | 88480 | 6188-198 |
| S108 | 00618-625 | | SWITCH ASSEMBLY, MOD | 88480 | 00618-628 |
| S103 | 3108-0001 | | SWITCH-BENS SPDT 870 18A 850VAC | 02987 | 82-2R8 |
| S306 | 3101-0033 | | SWITCH-BL DPDT-N8 870 .8A 128VAC/DC | 05086 | 11A-1009A |
| T1 | 9100-1703 | 1 | TRANSFORMER-POWER | 88480 | 9100-1703 |
| T81 | 0360-0064 | 1 | BARRIER BLOCK 11-TERM SINGLE SOLDER LUG | 0480G | 354-17-11-001 |
| V101 | 1932-0048 | 1 | TUBE-ELECTRON 18AU7 TRIODE-DUAL | 84978 | ECC 81 |
| | 1200-0003 | | SOCKET-TUBE 9-CON7 | 0450G | 121-31-18-104 |
| | 1880-0007 | | SHIELD-TUBE | 7178E | 181-11-23-013 (101) |
| V108 | 1930-0013 | | TUBE-ELECTRON 6AL5 DIODE-DUAL | 33173 | 6AL5 |
| | 1800-0017 | | SOCKET-TUBE 7-CON7 8LDR-EYE | 0480G | 111-39-11-018 |
| V103 | 1932-0046 | 7 | TUBE-ELECTRON 12AU7 TRIODE-DUAL | 33173 | 12AU7 |
| | 1880-0009 | | SHIELD-TUBE | 7178E | 181-11-23-018 |
| | 1800-0003 | | SOCKET-TUBE 9-CON7 | 0450G | 121-31-18-104 |
| V104 | 1932-0046 | | TUBE-ELECTRON 18AU7 TRIODE-DUAL | 33173 | 18AU7 |
| | 1800-0003 | | SOCKET-TUBE 9-CON7 | 0480G | 181-31-18-104 |
| | 1880-0009 | | SHIELD-TUBE | 7178E | 151-11-23-012 |
| V105 | 1932-0046 | 1 | TUBE-ELECTRON 18AU7 TRIODE-DUAL | 33173 | 18AU7 |
| | 1800-0003 | | SOCKET-TUBE 9-CON7 | 0480G | 181-31-18-104 |
| | 1820-0009 | | SHIELD-TUBE | 7178E | 151-11-23-012 |
| V106 | 1930-0013 | | TUBE-ELECTRON 6AL5 DIODE-DUAL | 33173 | 6AL5 |
| | 1200-0017 | | SOCKET-TUBE 7-CON7 8LDR-EYE | 0480G | 111-39-11-018 |
| V107 | 1932-0046 | 1 | TUBE-ELECTRON 12AU7 TRIODE-DUAL | 33173 | 12AU7 |
| | 1800-0003 | | SOCKET-TUBE 9-CON7 | 0450G | 181-31-18-104 |
| | 1220-0009 | | SHIELD-TUBE | 7178E | 151-11-23-018 |
| V108 | 1930-0013 | | TUBE-ELECTRON 6AL5 DIODE-DUAL | 33173 | 6AL5 |
| | 1800-0017 | | SOCKET-TUBE 7-CON7 8LDR-EYE | 0450G | 111-39-11-018 |
| V109 | 1932-0046 | 1 | TUBE-ELECTRON 12AU7 TRIODE-DUAL | 33173 | 12AU7 |
| | 1800-0003 | | SOCKET-TUBE 9-CON7 | 0450G | 121-31-12-104 |
| | 1280-0009 | | SHIELD-TUBE | 7178E | 181-11-83-018 |
| V110 | 1941-0005 | | TUBE-ELECTRON 8081 THYRATRON | 33173 | 8081 |
| | 1800-0017 | | SOCKET-TUBE 7-CON7 8LDR-EYE | 0450G | 111-39-11-018 |
| V111 | 1932-0046 | 1 | TUBE-ELECTRON 12AU7 TRIODE-DUAL | 33173 | 12AU7 |
| | 1200-0003 | | SOCKET-TUBE 9-CON7 | 0480G | 121-31-12-104 |
| | 1820-0009 | | SHIELD-TUBE | 7178E | 151-11-23-018 |
| V114 | 6188-98C | | ELECTRON TUBE, 8K 1316 KLYSTRON | 28480 | 6188-95G |
| | | | (FOR 618C ONLY) | | |
| V114 | 620A-98C | 1 | ELECTRON TUBE, 8K 1315 KLYSTRON | 28480 | 620A-95C |
| | | | (FOR 620B ONLY) | | |
| V118 | 1932-0046 | | TUBE-ELECTRON 12AU7 TRIODE-DUAL | 33173 | 12AU7 |
| | 1800-0003 | | SOCKET-TUBE 9-CON7 | 0450G | 121-31-12-104 |
| | 1220-0009 | | SHIELD-TUBE | 7178E | 181-11-23-018 |
| 620B MISC. ONLY | 00680-60038 | 1 | BOARD ASSEMBLY, RESISTOR | 88480 | 00620-60035 |
| | 620A-3488 | 1 | ATTENUATOR ASSEMBLY | 88480 | 620A-3488 |
| | 00620-683 | 1 | SOLOMETER ASSEMBLY | 88480 | 00680-623 |
| | 00620-686 | 1 | PROBE ASSEMBLY, SAMPLE | 88480 | 00680-624 |
| 618C MISC. ONLY | 6188-27 | 1 | FILTER, R.F. | 28480 | 6188-27 |
| | 6188-34AA | 1 | ATTENUATOR ASSEMBLY | 28480 | 6188-34AA |
| | 6188-38 | 1 | DRIVE ASSEMBLY, ATTENUATOR | 28480 | 6188-38 |
| | 6188-36AK | 1 | FILTER, REPELLER ASSEMBLY | 88480 | 6188-36AK |
| | 6188-36AP | 1 | CAPACITOR/ATTENUATOR HOUSING | 28480 | 6188-36AP |

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|--|----------|-----------------|
| 618C/620B MISC. | 6188-368C | 1 | PLUNGER ASSEMBLY | 28480 | 6188-368C |
| | 6188-47C | 1 | SPACER, DIAL WINDOW | 28480 | 6188-47C |
| | 6188-408 | 1 | COVER, FREQ DIAL | 28480 | 6188-408 |
| | 00618-024 | 1 | BRACKET, MODULATOR POTS | 28480 | 00618-024 |
| | 00618-622 | 1 | CONTROL ASSEMBLY, FREQ. | 28480 | 00618-622 |
| | 00618-623 | 1 | SOLOMETER ASSEMBLY | 28480 | 00618-623 |
| | 00618-640 | 1 | PROBE ASSEMBLY, SAMPLE | 28480 | 00618-640 |
| | 00618-60105 | 1 | BOARD ASSEMBLY, TRACKING RESISTOR | 28480 | 00618-60105 |
| | 1251-019A | 2 | CONNECTOR-PC EDGE 15-CONT/ROW 1-ROW | 03390 | 91-6915-1113-00 |
| | 1251-023A | 1 | CONNECTOR-PC EDGE 6-CONT/ROW 1-ROW | 03390 | 91-6906-5500-00 |
| | 1251-103B | 2 | CONNECTOR 7-PIN F HEXAGONAL | 05008 | M7P |
| | 1251-1037 | 1 | CONNECTOR 7-PIN M HEXAGONAL | 05008 | M7P |
| | 6188-528 | 1 | COVER, SOCKET HOUSING | 28480 | 6188-528 |
| | 00618-628 | 2 | DETECTOR ASSEMBLY, SOLOMETER | 28480 | 00618-628 |
| | 6188-40P | 1 | DIAL, FREQUENCY VERNIER | 28480 | 6188-40P |
| | 6188-52 | 1 | SOCKET ASSEMBLY | 28480 | 6188-52 |
| | 6188-40M | 1 | DIAL ASSEMBLY, PULSE WIDTH | 28480 | 6188-40M |
| | 6188-40G | 1 | DIAL ASSEMBLY, PULSE RATE | 28480 | 6188-40G |
| | 6188-40F | 1 | DIAL ASSEMBLY, PULSE DELAY | 28480 | 6188-40F |
| | 6188-40C | 1 | DIAL, ATTENUATOR | 28480 | 6188-40C |
| | 6188-40E | 1 | DIAL, POWER SET | 28480 | 6188-40E |
| | 0340-0020 | 1 | STANDOFF-RND .75L6 6-327MO .37500 STTT | 28480 | 0340-0020 |
| | 0370-0028 | 1 | KNOB-ROUND BLACK 1" DIA | 28480 | 0370-0028 |
| | 0370-0029 | 1 | KNOB-BLACK W/ARROW 1" DIA 1/4" SHAFT | 28480 | 0370-0029 |
| | 0370-0035 | 1 | KNOB-SKIRTED BAR 1" DIA | 28480 | 0370-0035 |
| | 0370-0038 | 1 | KNOB-BLACK 1-5/8" DIA | 28480 | 0370-0038 |
| | 0370-0050 | 1 | HANDLE-CRANK ONLY 3/8" OD | 28480 | 0370-0050 |
| | 00618-624 | 1 | PULSER ASSEMBLY | 28480 | 00618-624 |
| | 1200-0053 | 2 | SOCKET-TUBE 7-CONT DIP-SLDR | 04508 | 111-51-11-069 |
| | 1200-0062 | 2 | SOCKET-TUBE 9-CONT DIP-SLDR | 04506 | 121-51-11-060 |
| | 1200-0062 | 2 | SOCKET-TUBE 9-CONT DIP-SLDR | 04506 | 121-51-11-060 |
| | 1200-0053 | 2 | SOCKET-TUBE 7-CONT DIP-SLDR | 04506 | 111-51-11-069 |
| | 5020-023A | 1 | MUS, DIAL | 28480 | 5020-023A |
| | 5020-0278 | 1 | GEAR, OFFSET TOOTH | 28480 | 5020-0278 |
| | 5040-0216 | 1 | WINDOW, DIAL ATTENUATOR | 28480 | 5040-0216 |
| | 6188-38 | 1 | WRENCH, SOCKET | 28480 | 6188-38 |
| | 00618-6077 | 2 | BOARD ASSEMBLY, MODULATOR | 28480 | 00618-6077 |
| | 00618-6078 | 2 | BOARD ASSEMBLY, MODULATOR | 28480 | 00618-6078 |
| | 00618-634 | 1 | CABINET ASSEMBLY | 28480 | 00618-634 |
| | 00618-635 | 1 | RACK CABINET ASSEMBLY | 28480 | 00618-635 |
| | 8120-1378 | 1 | CABLE ASSY 18AWG 3-CNDCT J8K-JMT .25-00 | 28480 | 8120-1378 |
| | 1251-2357 | 1 | CONNECTOR-AC PHR HP-9 MALE FLG-MTG | 05056 | EAC-301 |
| | 00618-00077 | 1 | SCREEN, CABINET | 28480 | 00618-00077 |
| | 7120-4162 | 4 | LABEL, WARNING-MAZARDOUS VOLTAGE-LARGE | 28480 | 7120-4162 |
| | 7120-4163 | 3 | LABEL, WARNING-MAZARDOUS VOLTAGE-SMALL | 28480 | 7120-4163 |
| | 7120-5087 | 1 | LABEL, WARNING-TO PREVENT ELECT. SHOCK | 28480 | 7120-5087 |
| | 00618-60107 | 1 | VOLTAGE DIVIDER BOARD ASSEMBLY (INCLUDES RS20-522, RS24, RS25 & RS27) | 28480 | 00618-60107 |
| | 6188-16L | 1 | CABLE, SHIELDED | 28480 | 6188-16L |
| | 00618-00075 | 1 | BRACKET, 6.3V REGULATOR | 28480 | 00618-00075 |
| | 0340-0875 | 1 | INSULATOR-X87R 7MM-CNDCT | 28480 | 0340-0875 |

See introduction to this section for ordering information

Table 6-3. Code List of Manufacturers

| Mfr Code | Manufacturer Name | Address | Zip Code |
|----------|-------------------------------------|--------------------------|----------|
| 00000 | U.S.A. COMMON | ANY SUPPLIER OF THE U.S. | |
| 0100M | ILLUMINATED PRODUCTS INC | ANAMEIM CA | |
| 00656 | AEROVOX CORP | NEW BEDFORD MA | 02741 |
| 0160G | ALLEN-BRADLEY CO | MILWAUKEE WI | |
| 0186G | FERROXCUBE CORP | SAUGERTIES NY | |
| 0192A | RCA CORP SOLID STATE DIV | SOMERVILLE NJ | |
| 0203G | MOTOROLA SEMICONDUCTOR PRODUCTS | PHOENIX AZ | |
| 0223G | FAIRCHILD SEMICONDUCTOR DIV | MOUNTAIN VIEW CA | |
| 0E957 | MICRO-SWITCH CO | BALA CYNHYD RA | 19004 |
| 0246J | CTS OF ASHVILLE INC | SKYLAND NC | |
| 02588 | CLAROSTAT MFG CO INC | DOVER NH | |
| 14A10 | RAYTHEON CO SRL U-WAVE DEVICES DIV | WALTHAM MA | 02154 |
| 0271C | GENERAL INSTR CORR SEMICON PROD GP | HICKSVILLE NY | |
| 0299E | MEPCO/ELECTRA CORP | MINERAL WELLS TX | |
| 03298 | CORNING GLASS WORKS (BRADFORD) | BRADFORD PA | |
| 24972 | AEG-TELEFUNKEN CORP | ENGLEWOOD CLIFF NJ | 07632 |
| 0339D | METHODE ELECTRONICS INC | CHICAGO IL | |
| 03418 | CORNING GLASS WORKS (WILMINGTON) | WILMINGTON NC | |
| 28480 | HP DIV 00 CORPORATE | PALO ALTO CA | |
| 03740 | BOURNS INC TRIMPOT PROD DIV | RIVERSIDE CA | |
| 33173 | GE CO TUBE DEPT | OWENSBORO KY | 42301 |
| 0379J | CTS OF BROWNSVILLE INC | BROWNSVILLE TX | |
| 0420J | SPRAGUE ELECTRIC CO | NORTH ADAMS MA | |
| 0448J | BUSSMAN MFG DIV OF MCGRAW-EDISON CO | ST LOUIS MO | |
| 0450G | TRW ELEK COMPONENTS CINCH DIV | ELK GROVE VLG IL | |
| 72136 | ELECTRO MOTIVE CORP SUB IEC | WILLIMANTIC CT | 06226 |
| 0457I | AMPEREX ELECTRONIC CORR | HICKSVILLE LI NY | |
| 74276 | SIGNALITE DIV GENERAL INST CORP | NERTUNE NJ | 07753 |
| 0470C | LITTELFUSE INC | DES PLAINES IL | |
| 05008 | WINCHESTER ELEK DIV LITTON IND INC | OAKVILLE CT | |
| 0505G | SWITCHCRAFT INC | CHICAGO IL | |
| 05520 | DALE ELECTRONICS INC | COLUMBUS NE | |
| 0599A | CIFTE | FR | |

APPENDIX I
ILLUSTRATED PARTS IDENTIFICATION

MODELS 618C-620B

SHF
SIGNAL GENERATOR

| REF. STOCK NO. | DESCRIPTION | QTY. |
|----------------|-------------------------|------|
| 1 | See Figures 2 & 3 | |
| 2 | See Figure 4 | |
| 3 | See Figures 5, 6, 7 & 8 | |
| 4 | See Figure 9 | |
| 5 | See Figures 13, 14 & 15 | |

| REF. STOCK NO. | DESCRIPTION | QTY. |
|----------------|-------------|------|
| | | |
| | | |
| | | |
| | | |

| REF. STOCK NO. | DESCRIPTION | QTY. |
|----------------|-------------|------|
| | | |
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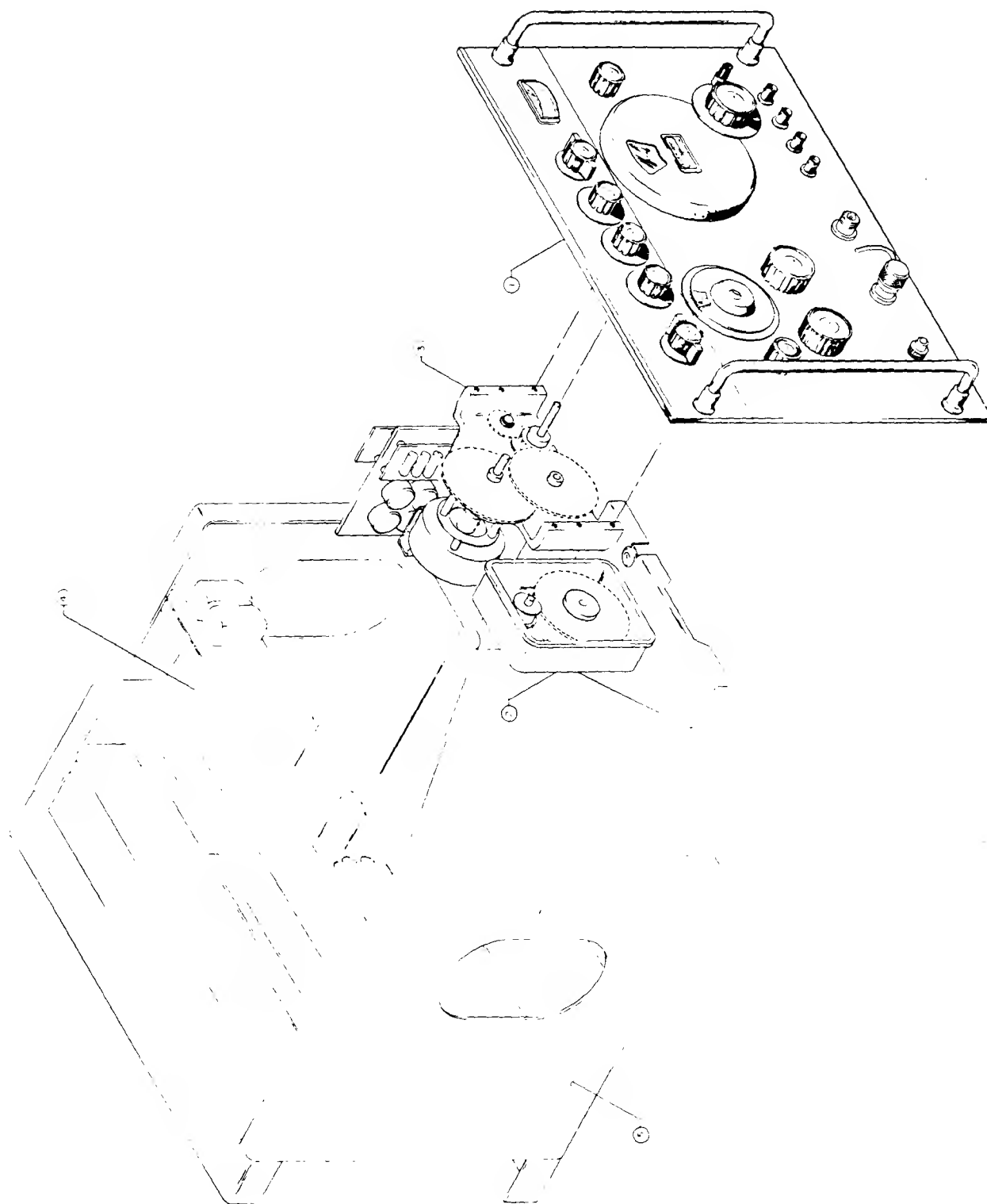


Figure I-1. HP Model 618C/620B S. H. F. Signal Generator, General Arrangement

Parts List for Figure I-2

| REF. | STOCK NO | DESCRIPTION | QTY. |
|------|-----------|--|------|
| 1 | 2990-0002 | Screw, Truss head ss, 10-24 thd, 1/2 in. lg | 17 |
| 2 | 2530-0003 | Screw, Flat head ss, 8-32 thd, 1/2 in. lg | 4 |
| 3 | 2930-0004 | Screw, Flat head ss, 10-24 thd, 1/2 in. lg | 1 |
| 4 | 2550-0009 | Screw, Bind. head, ss, with ext lock, 8/32 thd, 1/2 in. lg | 3 |
| 5 | 08614-626 | Cap Assy, RF Conn | 1 |
| 6 | 2370-0001 | Screw, Flat head ss, 6-32 thd, 1/4 in. lg | 4 |
| 7 | 2210-0002 | Screw, Flat head ss, 4-40 thd, 1/4 in. lg | 3 |
| 8 | 2550-0007 | Screw, Bind. head ss, with ext lock, 8-32 thd, 3/8 in. lg | 1 |
| 9 | 0520-0025 | Screw, Round head ss, 2-56 thd, 1/8 in. lg | 2 |
| 10 | 2200-0010 | Screw, Round head ss, 4-40 thd, 3/4 in. lg | 4 |
| 11 | 3030-0001 | Screw, Allen dr set, 8-32 thd, 3/16 in. lg | 24 |
| 12 | 3050-0032 | Washer, 5/16 in. od, 0.190 in. id, brass | 13 |
| 13 | 0520-0015 | Screw, Round head, 2-56 thd, 5/16 in. lg | 2 |
| 14 | 2190-0016 | Washer, Int lock, 1/2 in. od | 7 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|---|------|
| 15 | 2950-0001 | Nut, 1/2 in. wide, 3/8-32 thd, br | 7 |
| 16 | 0370-0035 | Knob, 1 in. dia blk, 1/4 in. shaft, w/arrow | 2 |
| 17 | | Not assigned | |
| 18 | 0370-0029 | Knob, 1 in. dia blk, 1/4 in. shaft, w/arrow | 2 |
| 19 | 0370-0038 | Knob, 1-5/8 in. dia blk, 1/4 in. shaft | 2 |
| 20 | 0370-0050 | Knob, 3/8 in. dia blk, crank handle | 1 |
| 21 | 1410-0033 | Bushing, Knob 0.219 od, 0.140 id | 1 |
| 22 | 2410-0001 | Screw, Oval Phillips, 6-32 thd, 5/8 in. lg | 1 |
| 23 | 618B-40P | Dial Assy, Vernier | 1 |
| 24 | 618B-40H | Dial, Pulse width | 1 |
| 25 | 618B-40F | Dial, Pulse delay | 1 |
| 26 | 618B-40G | Dial, Pulse rate | 1 |
| 27 | 618B-3E | Handle, Panel | 2 |
| 28 | 61B-3AT | Ferrule, Panel handle | 4 |
| 29 | 1250-0141 | Body, Clamp | 2 |
| 30 | 1250-0142 | Nut, Clamp | 2 |
| 31 | 1250-0143 | Washer, Shouldered | 2 |
| 32 | 1250-0144 | Body, Connector | 2 |
| 33 | 1250-0145 | Gasket, V groove | 2 |
| 34 | 1250-0146 | Washer, Flat | 2 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|----------------|---|------|
| 35 | 1250-0147 | Nut, Connector | 2 |
| 36 | 1250-0148 | Washer, Insulating | 2 |
| 37 | 1250-0017 | Contact, Female | 2 |
| 38 | 3050-0016 | Washer, no. 6, 9/32 in. od, nickel pl brass | 1 |
| 39 | 5040-0214 | Bead A (618C) | 2 |
| | 5040-0215 | Bead C (620B) (signal side) | 1 |
| 40 | 3101-1248 | Switch, Push | 1 |
| 41 | 5020-0234 | Hub, Dial 1 in. dia | 1 |
| 42 | 61B-40D-4 | Plate, Freq dial | 1 |
| 43 | 00618-00076 | Blank Dial, Freq | 1 |
| 44 | 618B-40E | Dial, Power set | 1 |
| 45 | 618B-40C | Dial, Attenuator (618C) | 1 |
| | 620A-40A | Dial, Atten. (620B) | 1 |
| 46 | 5040-0216 | Indicator, Dial marked atten | 1 |
| 47 | 618B-47C | Spacer, Window | 2 |
| 48 | 61B-40D-1 | Window, Dial (618C) | 1 |
| | 620A-40B | Window, Dial (620B) | 1 |
| 49 | 00618-00072 | Cover, Dial | 1 |
| 50 | 5001-0107 | Cover, Attenuator dial | 1 |
| 51 | 00618-00073 | Panel, Front | 1 |
| | 00618-00074 | Panel, Front (rack mtg) | 1 |
| 52 | 2190-0014 | Washer, Int lock 1/2 in. od | 2 |
| 53 | 3050-0017 | Washer, 3/8 in. od, 0.26 in. id, bronze | 5 |
| 54 | 618B-16S-T-U-V | Cable Assy | 4 |
| 55 | 2140-0244 | Lamp, Glow | 1 |

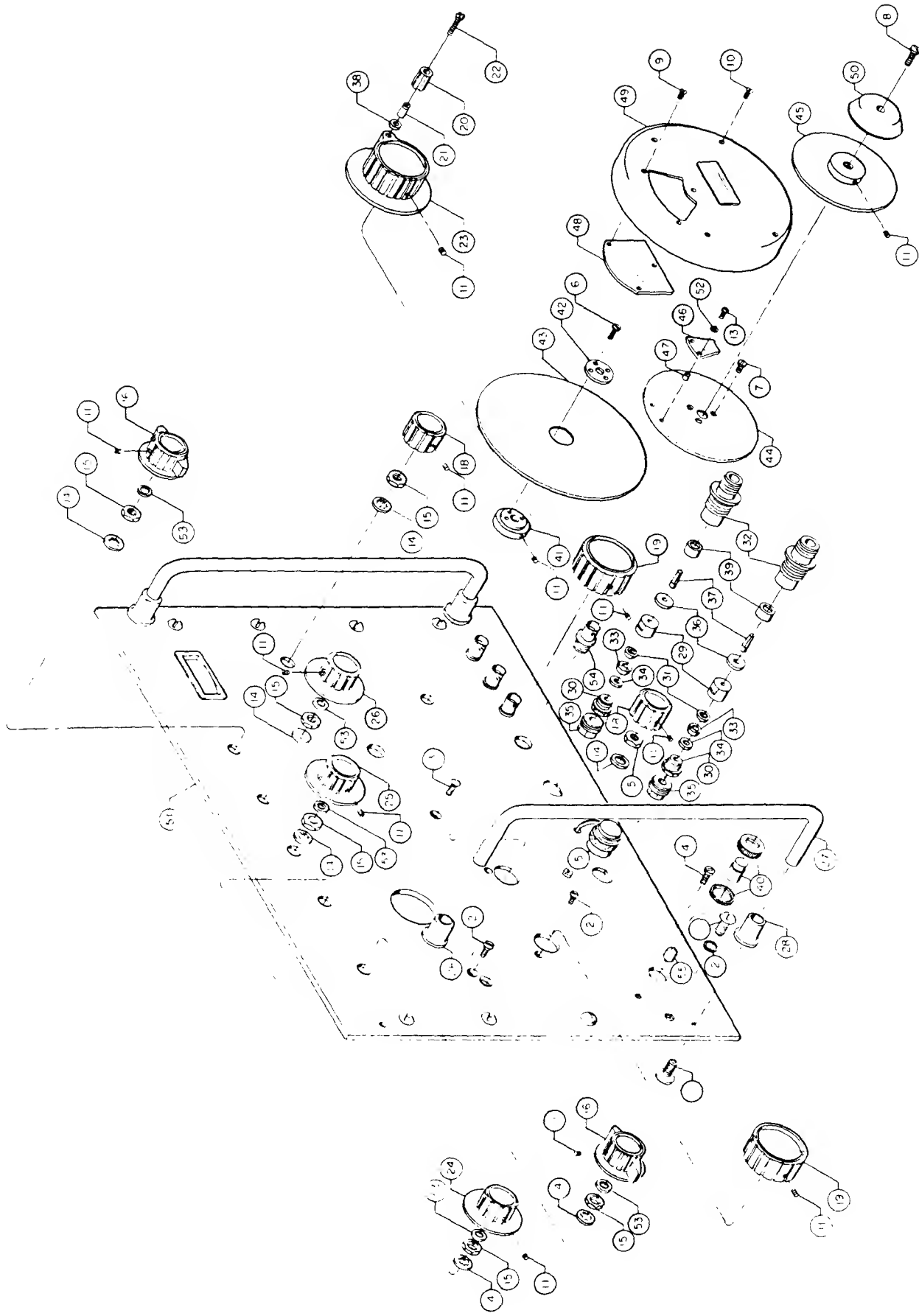


Figure I-2. HP Model 618C/620B S.H.F. Signal Generator, Control Panel, Front View

Parts List for Figure I-3

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|---|------|
| 1 | 5020-0319 | Shaft, 1/4 in. ss, 1-3/16 in. lg | 5 |
| 2 | 1410-0003 | Bushing, Threaded 3/8-32, 1/2 in. lg | 5 |
| 3 | 5000-0206 | Washer, Spring 9/16 in. dia | 5 |
| 4 | 5020-0238 | Head Coupler 3/4 in. dia | 5 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|--------------------|--|------|
| 5 | 3030-0001 | Screw, Allen dr set 8-32 thd, 3/16 in. lg | 10 |
| 6 | 5020-0318 | Shaft | 5 |
| 7 | 2950-0042 | Nut, 1 in. wide, 3/4-20 thd, br | 2 |
| 8 | 2190-0051 | Washer, Int lock 1 in. od | 2 |
| 9 | 618B-16S- T-U-V | Cable Assy | 4 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|--|------|
| 10 | 2190-0016 | Washer, Int lock 1/2 in. od | 2 |
| 11 | 2100-0047 | Resistor, Variable | 2 |
| 12 | 3101-1395 | Switch, Push | 1 |
| 13 | 2280-0012 | Screw, Round head, 4-40 thd, 3/4 in. lg | 2 |
| 14 | 1120-1277 | Meter | 1 |

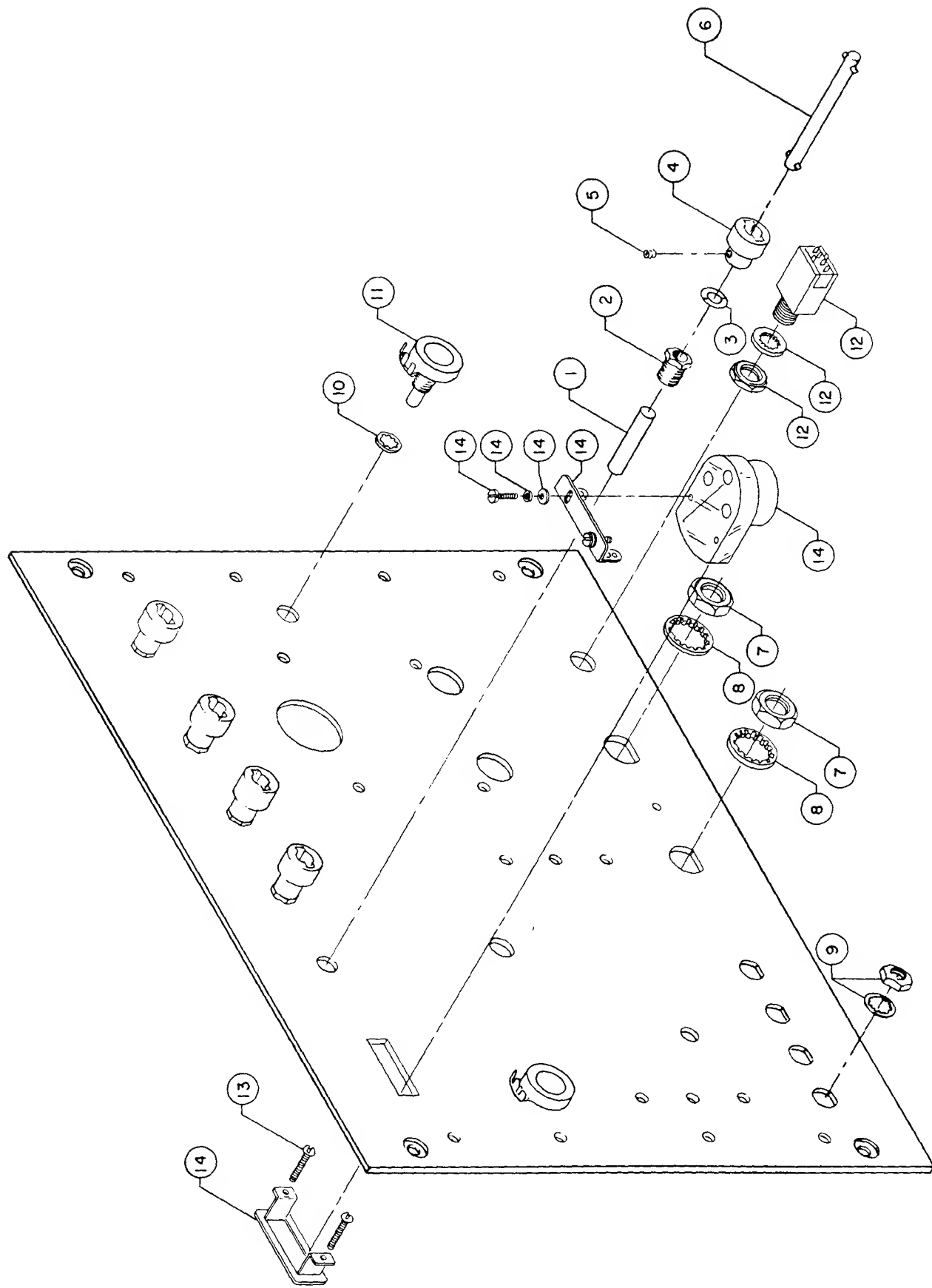


Figure I-3. HP Model 618C/620B S.H.F. Signal Generator, Control Panel, Rear View

Parts List for Figure I-4

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|--------------------------------------|------|
| 1 | 618B-35A | Housing | 1 |
| 2 | 618B-35B | Guide, Rack | 1 |
| 3 | 618B-35D | Spacer, Bearing | 1 |
| 4 | 618B-35E | Tube, Drive | 1 |
| 5 | 618B-35G | Hub, Gear | 1 |
| 6 | 618B-35H | Bracket, Gear | 1 |
| 7 | 618B-35I | Shaft, Monitor | 1 |
| 8 | 618B-35J | Shaft, Attenuator | 1 |
| 9 | 618B-35K | Gear, Idler | 1 |
| 10 | 618B-35L | Gear, Idler | 1 |
| 11 | 618B-35M | Gear, Driven | 1 |
| 12 | 618B-35N | Gear, Driven | 1 |
| 13 | 618B-35P | Gear, Rack | 1 |
| 14 | 618B-35P | Gear, Rack | 1 |
| 15 | 5020-0233 | Collar, 1/4 in. shaft 1/2 in. dia | 3 |
| 16 | 5000-0206 | Washer, Spring, 9/16 in. dia | 4 |
| 17 | 5020-0256 | Shaft | 2 |
| 18 | 618B-35Q | Gear, Attenuator dial | 1 |
| 19 | 618B-35R | Gear, Monitor | 1 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|--|------|
| 20 | 618B-35S | Gear, Drive | 1 |
| 21 | 618B-35T | Gear, Drive | 1 |
| 22 | 618B-35U | Gear, Drive | 1 |
| 23 | 618B-35V | Gear, Drive | 1 |
| 24 | 620A-91A | Spring, Rack Load | 1 |
| 25 | 5020-3368 | Collar, 3/16" id, 1/2" od | 1 |
| 26 | 1410-0004 | Bearing, Ball, 5/8 od, 1/4 id | 1 |
| 27 | 1410-0007 | Bearing, Ball, 1/2 od, 3/16 id | 2 |
| 28 | 1410-0012 | Bearing, Ball 7/8 od, 3/8 id | 2 |
| 29 | 1460-0048 | Spring, Extension | 4 |
| 30 | 2210-0002 | Screw, Flat head ss, 4-40 thd, 1/4 in. lg | 9 |
| 31 | 2190-0003 | Washer, Split lock for no. 4 screw | 3 |
| 32 | 2260-0001 | Nut, 1/4 in. wide 4-40 thd, ss | 3 |
| 33 | 0380-0017 | Spacer | 1 |
| 34 | 3030-0001 | Screw, Allen dr set 8-32 thd, 3/16 in. lg | 13 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|--|------|
| 35 | 3030-0007 | Screw, Allen dr set 4-40 thd, 1/8 in. lg | 8 |
| 36 | 3050-0017 | Washer, 3/8 in. od 0.26 in. id, bronze | A/R |
| 37 | 2550-0007 | Screw, Bind. head ss, 8-32 thd, 3/8 in. lg, w/ ext lock | 1 |
| 38 | 2420-0001 | Screw, Bind. head ss, 6-32 thd, 5/16 in. lg, w/ ext lock | 2 |
| 39 | 2380-0004 | Screw, Fil head ss, 6-32 thd, 3/4 in. lg | 1 |
| 40 | 3050-0106 | Washer, Brass .48 od, .338 id | 6 |
| 41 | 3050-0074 | Washer, Be Cu .75 od .255 id | 1 |
| 42 | 3030-0003 | Screw, Allen dr cap 6/32 thd, 3/8 in. lg | 1 |
| 43 | 1400-0015 | Clamp, Cable 1/4 in. dia, steel | 1 |
| 44 | 3050-0025 | Washer, Be Cu 1.25 od, .2812 id | 1 |

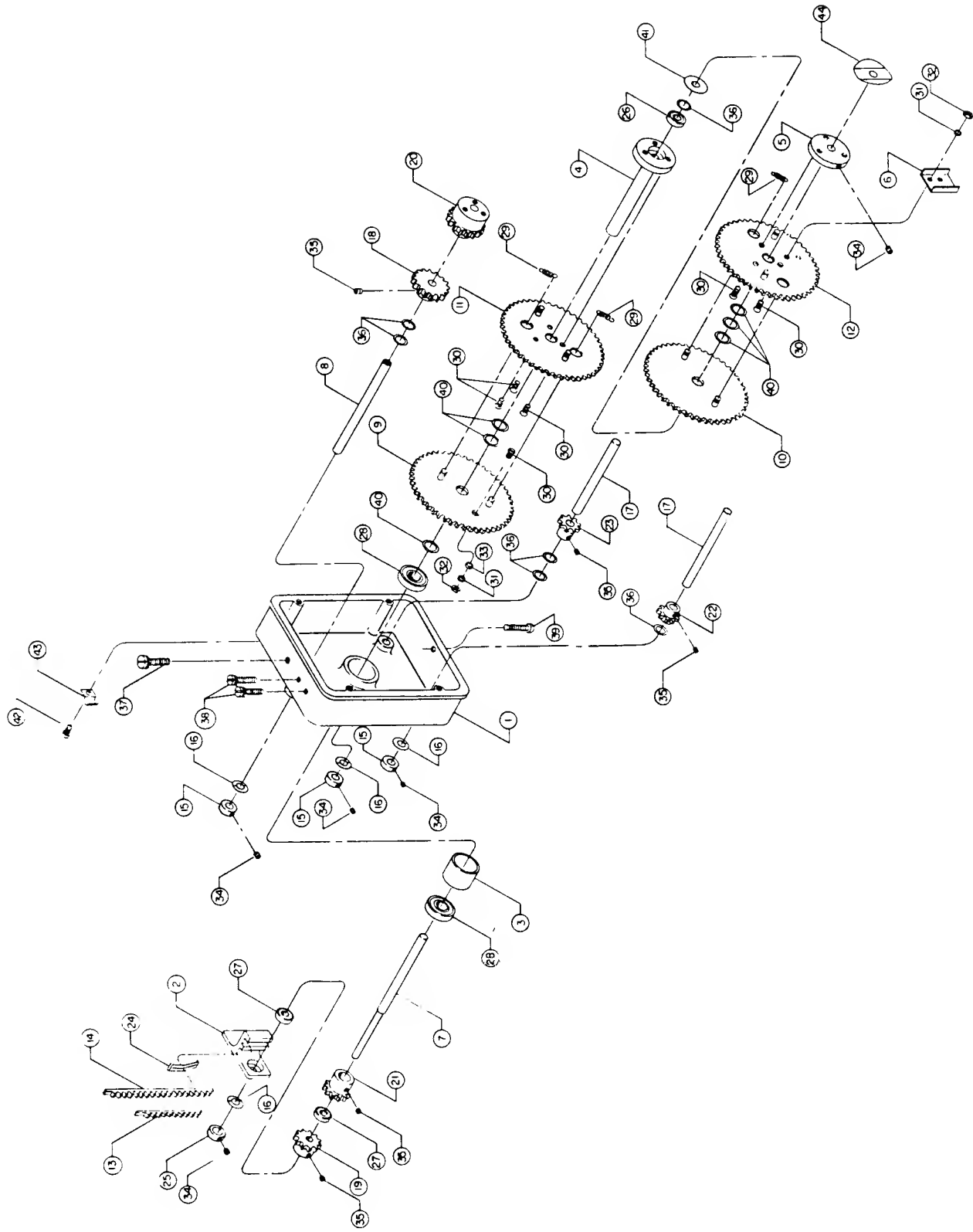


Figure I-4. HP Model 618C/620B S. H. F. Signal Generator, Attenuator Drive Mechanism

Parts List for Figure I-5

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-------------|---|------|
| 1 | 0160-0088 | Capacitor, Fxd paper 0.25 uf 10% 1.5K vdcw | 1 |
| 2 | 1400-0525 | Bracket, Mtg footed | 2 |
| 3 | 1410-0009 | Bearing, Ball .75 od .25 bore | 2 |
| 4 | 1460-0048 | Spring, Extension .688 lg | 4 |
| 5 | 2100-0127 | Resistor, Variable 100K ohms 10%, 8w | 1 |
| 6 | 3102-0001 | Switch, SPDT | 1 |
| 7 | 3102-0002 | Lever, Switch actuator | 1 |
| 8 | 5020-0233 | Collar, 1/4 in. shaft 1/2 in. dia | 2 |
| 9 | 5020-0278 | Gear, Offset tooth | 1 |
| 10 | 5020-0340 | Shaft, 1/4 in. ss 1-5/16 in. long | 1 |
| 11 | 5020-0349 | Shaft, 2-3/4 in. long | 1 |
| 12 | 608D-47J | Spacer, Stop gear | 1 |
| 13 | 618B-27 | Filter Assy | 1 |
| 14 | 618B-36P | Gear, Idler | 1 |
| 15 | 618B-36L | Retainer, Freq | 2 |
| 16 | 618B-36Q | Gear, Freq | 1 |
| 17 | | NOT ASSIGNED | |
| 18 | 00618-20067 | Pot Mounting Assembly | 1 |
| 19 | 618B-36AX | Gear, Freq drive | 1 |
| 20 | 618B-36N | Gear, Pot drive | 1 |
| 21 | 618B-36R | Gear, Freq | 1 |
| 22 | 00618-242 | Coupler, Potentiometer | 1 |
| 23 | 00618-2061 | Cavity Assy | 1 |
| 24 | 620A-36AA | Housing | 1 |
| 25 | 618B-3D | Shield, Tube | 1 |
| 26 | 618B-3G | Contact, Tube | 2 |
| 27 | 618B-3C | Nut, Tube | 1 |
| 28 | 00618-240 | Board, Terminal | 1 |
| 29 | 2100-0028 | Resistor, Variable 50K ohms 10% 2.25 w | 4 |
| 30 | 618B-34AA | Attenuator Assy | 1 |
| 31 | 618B-3F | Spring, Tube | 1 |
| 32 | 00618-226 | Probe, Bolometer | 1 |
| 33 | 620A-34D | Sleeve, Dielectric | 1 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|----------------|--|------|
| 34 | 1250-0005 | Nut, Connector | 1 |
| 35 | 1250-0006 | Washer, Connector | 1 |
| 36 | 1250-0007 | Gasket, Connector | 1 |
| 37 | 1250-0008 | Clamp, Connector | 1 |
| 38 | 1250-0141 | Clamping Body, RF connector | 1 |
| 39 | 1250-0142 | Nut, Clamp | 1 |
| 40 | 620A-34A -1 | Stop, Attenuator | 1 |
| 41 | 620A-28C | Stop, Plunger | 1 |
| 42 | 618B-3A | Clamp, Guide | 1 |
| 43 | 618B-35B | Guide, Rack | 1 |
| 44 | 620A-91A | Spring, Rack load | 1 |
| 45 | 618B-35P -L | Gear, Rack | 1 |
| 46 | 618B-35P -S | Gear, Rack | 1 |
| 47 | 00618-6070 | Socket Assembly | 1 |
| 48 | 1200-0014 | Socket, 4 Pin tube ring mounting | 1 |
| 49 | 8160-0008 | Braid, RF .25 dia aluminum | 6" |
| 50 | 1250-0143 | Washer, Shouldered | 1 |
| 51 | 1250-0145 | Gasket | 1 |
| 52 | 00618-00078 | Bracket | 1 |
| 53 | 618B-52B | Cover, Housing | 1 |
| 54 | 5020-0621 | Nut, 11/32 in. gland 9/16 in. dia | 1 |
| 55 | 3050-0022 | Washer, 7/16 in. od 5/16 in. id brass | 2 |
| 56 | 0890-0002 | Rubber, Tubing | 1/4" |
| 57 | | NOT ASSIGNED | |
| 58 | | NOT ASSIGNED | |
| 59 | 2950-0033 | Nut, 1/2 in. wide 3/8-32 thd, br | 4 |
| 60 | 3030-0001 | Screw, Allen dr set 8-32 thd, 3/16 in. lg | 13 |
| 61 | 3030-0007 | Screw, Allen dr set 4-40 thd, 1/8 in. lg | 1 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|--|------|
| 62 | 618B-88A | Ring, Seating | 1 |
| 63 | 1250-0146 | Washer, Flat | 1 |
| 64 | 1250-0147 | Nut, Retainer | 1 |
| 65 | 1250-0148 | Washer, Insulating | 1 |
| 66 | 1950-0004 | Klystron | 1 |
| 68 | 620A-90C | Nut, Tube collet | 1 |
| 69 | 2360-0018 | Screw, Round head ss 6-32 thd, 1-1/2 in. lg | 5 |
| 70 | 2190-0007 | Washer, Int lock for no. 6 screw | 7 |
| 71 | 3050-0066 | Washer, 3/8 in. od 0.147 in. id, brass | 20 |
| 72 | 3030-0064 | Screw, Cap sh 6-32 x .625 | 6 |
| 73 | 2680-0246 | Screw, Hex Head ss 10-24 Thd, 7/8 in. lg | 1 |
| 74 | 2190-0011 | Washer, Int lock for no. 10 screw | 1 |
| 75 | 3050-0019 | Washer, Flat brass 1/2 in. od | 1 |
| 76 | 3050-0005 | Washer, 3/8 in. od for no. 6 screw fiber | 4 |
| 77 | | NOT ASSIGNED | |
| 78 | 2580-0003 | Nut, 11/32 in. wide 8-32 thd, w/lock | 1 |
| 79 | 2390-0007 | Screw, Bind. head ss 6-32 thd, 5/16 in. lg | 1 |
| 80 | 2550-0009 | Screw, Bind. head ss 8-32 thd, 1/2 in. lg | 5 |
| 81 | 618B-47A | Support, Bracket | 1 |
| 82 | 3030-0016 | Screw, Allen dr cap 6-32 thd, 1/2 in. lg | 1 |
| 83 | 0520-0004 | Screw, Mach brs 2-56 x 3/16 fil hd sd ni-p | 2 |
| 84 | 00618-628 | Bolometer Detector Assy | 1 |
| 85 | 1251-0234 | Connector, F.C. board 6 pin | 1 |
| 86 | | NOT ASSIGNED | |

Model 618C/620B

Parts List for Figure I-5 (Cont'd)

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-------------|--|------|
| 87 | | NOT ASSIGNED | |
| 88 | 2190-0004 | Washer, Int lock for no. 4 screw | 2 |
| 89 | 2550-0007 | Screw, Bind. head ss 8-32 thd, 3/8 in. lg | 6 |
| 90 | 2190-0009 | Washer, Int lock for no. 8 screw | 2 |
| 91 | 0380-0003 | Spacer, 1/4 in. od., 1/8 in. lg | 1 |
| 92 | 2390-0009 | Screw, Bind. head ss 6-32 thd, 3/8 in. lg | 6 |
| 93 | 2220-0003 | Screw, Fil head ss 4-40 thd, 5/16 in. lg | 3 |
| 94 | 3050-0229 | Washer, 0.250 in. od, 0.117 in. id, ss | 1 |
| 95 | 2190-0061 | Washer, Split lock for no. 4 screw | 1 |
| 96 | 2200-0006 | Screw, Round head, ss, 4-40 thd, 3/8 in. lg | 3 |
| REF. | STOCK NO. | DESCRIPTION | QTY. |
| 97 | 00618-632 | Board Assy, Bolometer amplifier | 1 |
| 98 | 00618-640 | Sample Probe Assy | 1 |
| 99 | 2370-0003 | Screw, Flat head ss 6-32 thd, 1/2 in. lg | 6 |
| 100 | 0400-0001 | Grommet, Rubber for 3/4 in. hole | 1 |
| 101 | 0360-0064 | Board, Terminal | 1 |
| 102 | 2520-0002 | Screw, Round head ss 8-32 thd, 3/8 in. lg | 2 |
| 103 | 3050-0014 | Washer, 3/8 in. od 0.26 in. id, bronze | 4 |
| 104 | | NOT ASSIGNED | |
| 105 | | NOT ASSIGNED | |
| 106 | 00618-034 | Plate, Guard | 1 |
| 107 | 2360-0138 | Screw, machine 6-32 x 1.75", pan head, Pozi | 2 |
| REF. | STOCK NO. | DESCRIPTION | QTY. |
| 108 | | NOT ASSIGNED | |
| 109 | 2190-0496 | Washer, Flat Silicone Rubber; .85 ID, .975 OD, .06 thick | 2 |
| 110 | 2190-0006 | Washer, Split lock for no. 6 screw | 1 |
| 111 | 2390-0010 | Screw, Bind. head ss, 6-32 thd, 1/2 in. lg | 2 |
| 112 | 1400-0015 | Clamp, Cable 1/4 in. dia cad pl s | 5 |
| 113 | 2420-0002 | Nut, 6-32 thd x 5/16 in. ss | 1 |
| 114 | 5060-0016 | Washer, no. 6, 9/32 in. od, nickel pl brass | 1 |
| 115 | 2360-0205 | Screw: Machine 6-32 x 0.75" | 3 |
| 116 | 2360-0135 | Screw, pan head, ss 6-32 x 1.5" | 1 |
| 117 | 00618-2059 | Tube, Atten | 1 |
| 118 | 00618-2046 | Board, Insulator | 1 |
| 119 | 00618-60107 | Board, Vlt. divider | 1 |

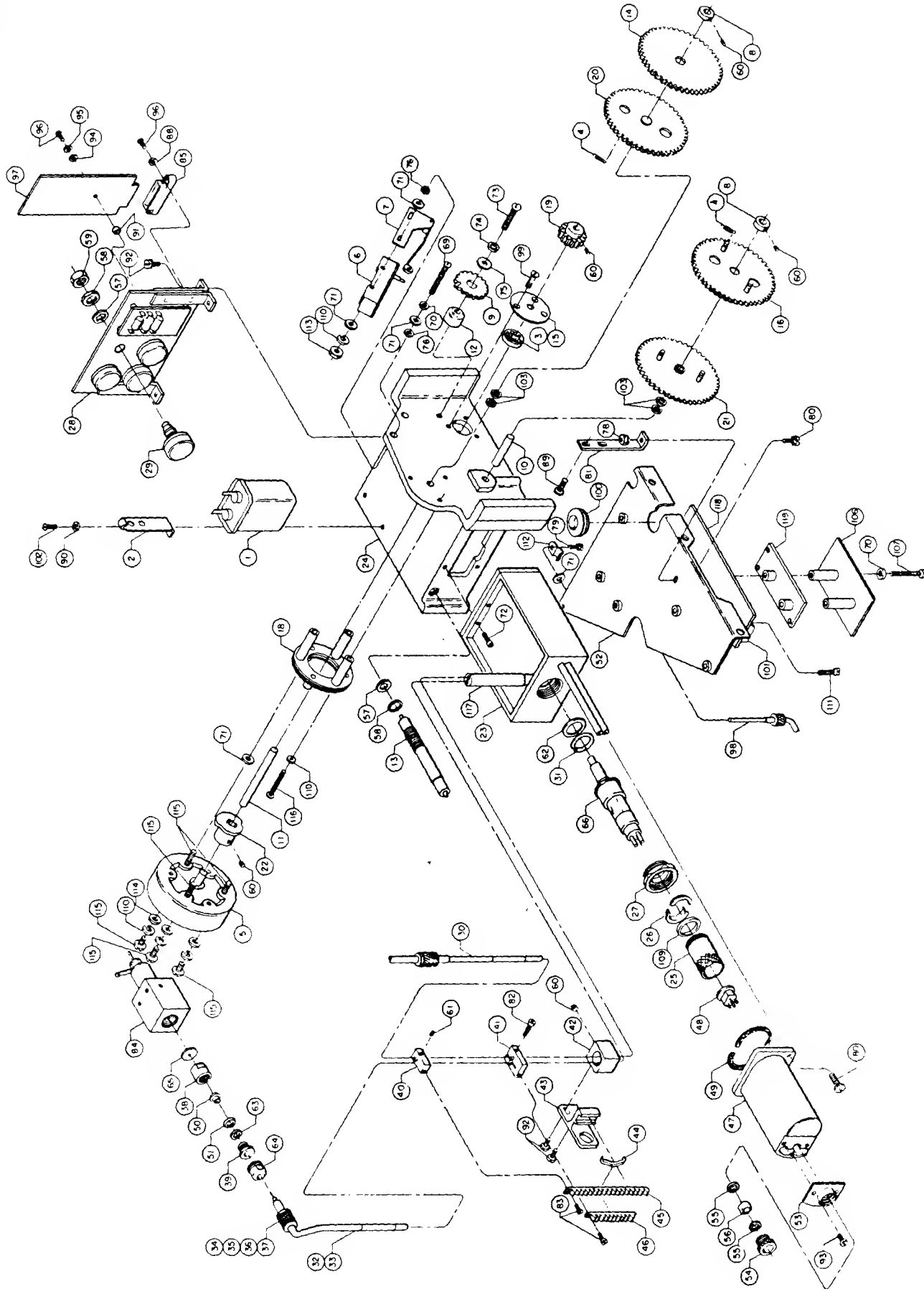


Figure I-5. HP Model 618C S.H.F. Signal Generator, Klystron Assembly and Drive Mechanism

Model 618C/620B

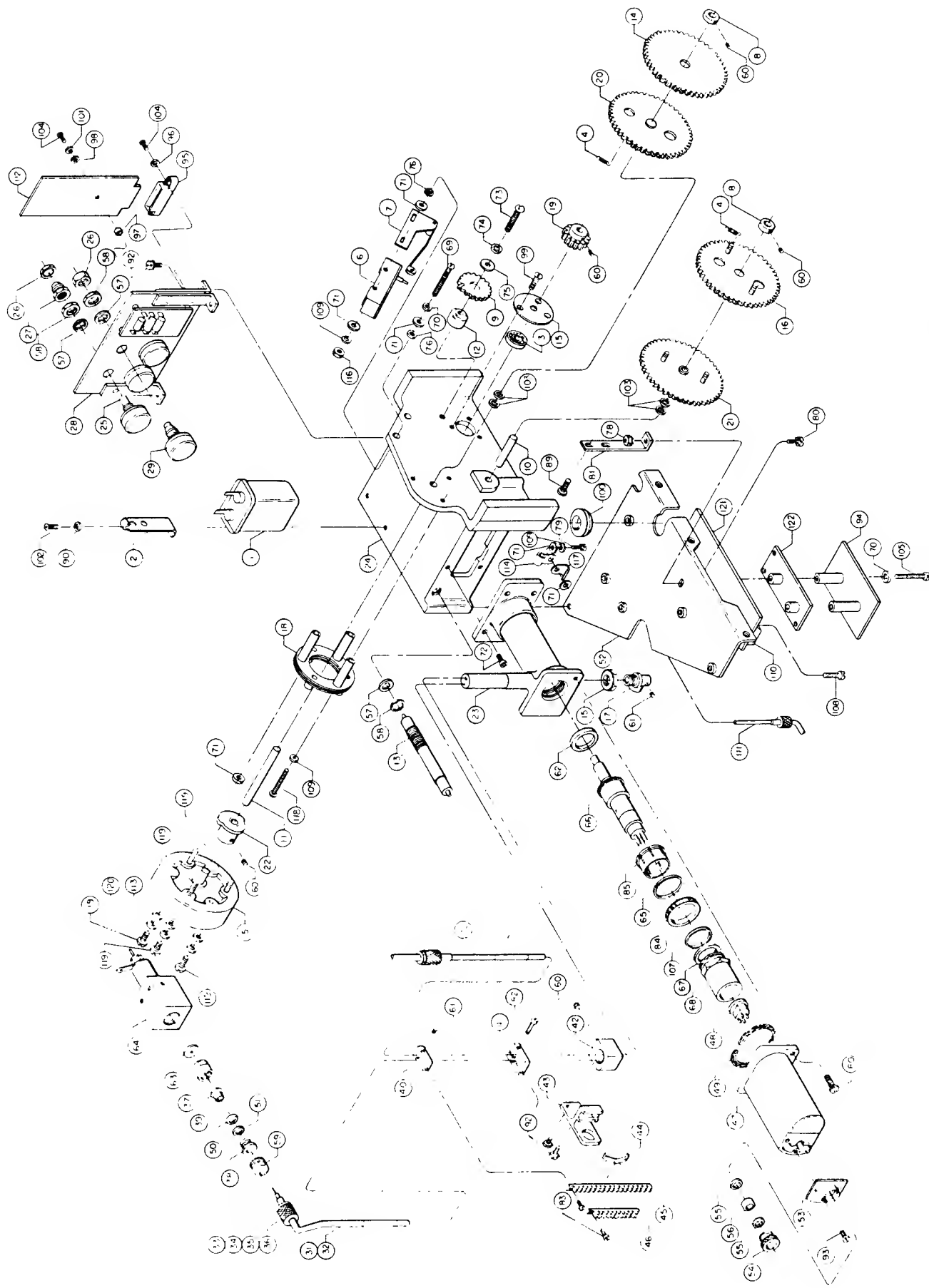


Figure I-6. HP Model 620B S.H.F. Signal Generator, Klystron Assembly and Drive Mechanism

Parts List for Figure I-6

| REF. | STOCK NO. | DESCRIPTION | QTY. | REF. | STOCK NO. | DESCRIPTION | QTY. | REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-------------|---|------|------|-------------|--|------|------|--------------|--|------|
| 1 | 0160-0088 | Capacitor, Fxd paper 0.25 uf 10% 1.5K vdcw | 1 | 32 | 620A-34D | Sleeve, Dielectric | 1 | 61 | 3030-0007 | Screw, Allen dr set 4-40 thd, 1/8 in. lg | 2 |
| 2 | 1400-0525 | Bracket, Mtg footed | 2 | 33 | 1250-0005 | Nut, Connector | 1 | 62 | 618B-88A | Ring, Seating | 1 |
| 3 | 1410-0009 | Bearing, Ball .75 od .25 bore | 2 | 34 | 1250-0006 | Washer, Connector | 1 | 63 | 1250-0148 | Washer, Insulating | 1 |
| 4 | 1460-0048 | Spring, Extension .688 lg | 4 | 35 | 1250-0007 | Gasket, Connector | 1 | 64 | 00618-628 | Bolometer Detector Assy | 1 |
| 5 | 2100-0120 | Resistor, Variable 100K ohms 5%, 8 w | 1 | 36 | 1250-0008 | Clamp, Connector | 1 | 65 | 0510-0779 | Ring, Lock | 1 |
| 6 | 3102-0001 | Switch, SPDT | 1 | 37 | 1250-0141 | Clamping Body, RF connector | 1 | 66 | 1950-0017 | Tube, Klystron | 1 |
| 7 | 3102-0002 | Lever, Switch actuator | 1 | 38 | 1250-0142 | Nut, Clamp | 1 | 67 | 620A-90D | Ring, Washer Telfon | 1 |
| 8 | 5020-0233 | Collar, 1/4 in. shaft 1/2 in. dia | 2 | 39 | 1250-0143 | Washer, Shouldered | 1 | 68 | 620A-90C | Nut, Tube collet | 1 |
| 9 | 5020-0277 | Gear, Offset tooth | 1 | 40 | 620A-34A | Stop, Attenuator | 1 | 69 | 2360-0018 | Screw, Round head ss 6-32 thd, 1-1/2 in. lg | 5 |
| 10 | 5020-0340 | Shaft, 1/4 in. ss 1-5/16 in. long | 1 | 41 | 620A-28C | Stop, Plunger | 1 | 70 | 2190-0007 | Washer, Int lock for no. 6 screw | 7 |
| 11 | 5020-0349 | Shaft, 2-3/4 in. long | 1 | 42 | 618B-3A | Clamp, Guide | 1 | 71 | 3050-0066 | Washer, 3/8 in. od 0.147 in. id, brass | 20 |
| 12 | 608D-47J | Spacer, Stop gear | 1 | 43 | 618B-35B | Guide, Rack | 1 | 72 | 3030-0064 | Screw, Cap sh 6-32 x .625 | 4 |
| 13 | 618B-27 | Filter Assy | 1 | 44 | 620A-91A | Spring, Rack load | 1 | 73 | 2680-0246 | Screw, Hex Head ss 10-24 Thd, 7/8 in. lg. | 1 |
| 14 | 618B-35L | Gear, Idler | 1 | 45 | 618B-35P | Gear, Rack | 1 | 74 | 2190-0011 | Washer, Int lock for no. 10 screw | 1 |
| 15 | 618B-36L | Retainer, Freq | 2 | 46 | 618B-35P | Gear, Rack | 1 | 75 | 3050-0019 | Washer, Flat brass 1/2 in. od | 1 |
| 16 | 618B-36Q | Gear, Freq | 1 | 47 | 00618-6070 | Socket Assembly | 1 | 76 | 3050-0005 | Washer, 3/8 in. od for no. 6 screw fiber | 4 |
| 17 | 00620-224 | Adapter | 1 | 48 | 1200-0014 | Socket, 4 Pin tube ring mounting | 6" | 77 | NOT ASSIGNED | | |
| 18 | 00618-20067 | Pot Mounting Assy | 1 | 49 | 8160-0008 | Braid, RF .25 dia aluminum | 1 | 78 | 2580-0003 | Nut, 11/32 in. wide 8-32 thd, w/lock | 1 |
| 19 | 618B-36AX | Gear, Freq drive | 1 | 50 | 1250-0145 | Gasket | 1 | 79 | 2390-0010 | Screw, Bind. head ss 6-32 thd, 1/2 in. lg | 1 |
| 20 | 620A-36P | Gear, Pot drive | 1 | 51 | 1250-0146 | Washer, Flat | 1 | 80 | 2550-0009 | Screw, Bind. head ss 8-32 thd, 1/2 in. lg | 5 |
| 21 | 620A-36R | Gear, Freq | 1 | 52 | 00618-00078 | Bracket | 1 | 81 | 618B-47A | Support, Bracket | 1 |
| 22 | 00620-242 | Coupler, Potentiometer | 1 | 53 | 618B-52B | Cover, Housing | 1 | 82 | 3030-0016 | Screw, Allen dr cap 6-32 thd, 1/2 in. lg | 1 |
| 23 | 00620-243 | Cavity Assy | 1 | 54 | 5020-0621 | Nut, 11/32 in. gland 9/16 in. dia | 1 | 83 | 0520-0004 | Screw, Mach brs 2-56 x 3/16 fil hd sd ni-p | 2 |
| 24 | 620A-36AA | Housing | 1 | 55 | 3050-0022 | Washer, 7/16 in. od 5/16 in. id brass | 2 | 84 | 00620-201 | Ring, Collet | 1 |
| 25 | 2100-0045 | Resistor, Variable 100K ohms, 10%, 1.12 w | 1 | 56 | 0890-0002 | Rubber, Tubing | 1/4" | | | | |
| 26 | 0590-0035 | Nut, for locking bush. | 4 | 57 | 2190-0016 | Washer, Int lock 1/2 in. od | 5 | | | | |
| 27 | 0590-0036 | Bushing, Locking | 1 | 58 | 2950-0001 | Nut, 1/2 in. wide 3/8-32 thd, br | 5 | | | | |
| 28 | 00618-240 | Board, Terminal | 1 | 59 | 1250-0147 | Nut, Retainer | 1 | | | | |
| 29 | 2100-0028 | Resistor, Variable 50K ohms 10%, 2.25 w | 3 | 60 | 3030-0001 | Screw, Allen dr set 8-32 thd, 3/16 in. lg | 13 | | | | |
| 30 | 620A-34BB | Attenuator Assy | 1 | | | | | | | | |
| 31 | 620A-28N | Bolometer Plunger Assy | 1 | | | | | | | | |

Model 618C/620B

Parts List for Figure I-6 (Cont'd)

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|---|------|
| 85 | 00620-200 | Collet, Tube | 1 |
| 86 | | NOT ASSIGNED | |
| 87 | | NOT ASSIGNED | |
| 88 | | NOT ASSIGNED | |
| 89 | 2550-0007 | Screw, Bind. head ss, 8-32 thd, 3/8 in. lg | 6 |
| 90 | 2190-0009 | Washer, Int lock for no. 8 screw | 2 |
| 91 | | NOT ASSIGNED | 4 |
| 92 | 2390-0009 | Screw, Bind. head ss, 6-32 thd, 3/8 in. lg | 6 |
| 93 | 2220-0003 | Screw, Fil head ss, 4-40 thd, 5/16 in. lg | 3 |
| 94 | 00618-034 | Plate, Guard | 1 |
| 95 | 1251-0234 | Connector, P.C. board 6 pin | 1 |
| 96 | 2190-0004 | Washer, Int lock for no. 4 screw | 2 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|--|------|
| 97 | 0380-0003 | Spacer, 1/4 in. od, 1/8 in. lg | 1 |
| 98 | 3050-0229 | Washer, 0.250 in. od, 0.117 in. id, ss, | 1 |
| 99 | 2370-0003 | Screw, Flat head ss, 6-32 thd, 1/2 in. lg | 6 |
| 100 | 0400-0001 | Grommet, Rubber for 3/4 in. hole | 1 |
| 101 | 2190-0061 | Washer, Split lock for no. 4 screw | 1 |
| 102 | 2520-0002 | Screw, Round head ss, 8-32 thd, 3/8 in. lg | 2 |
| 103 | 3050-0014 | Washer, 3/8 in. od, 0.26 in. id, bronze | 4 |
| 104 | 2200-0006 | Screw, Round head ss, 4-40 thd, 3/8 in. lg | 3 |
| 105 | 2360-0138 | Screw Machine 6-32 x 1.75" pan head, Pozi | 2 |
| 106 | | NOT ASSIGNED | |
| 107 | 2190-0496 | Washer, Flat Silicone Rubber; .85 ID, .975 OD, .06 thick | 1 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-------------|--|------|
| 108 | 2390-0010 | Screw, Bind. head ss, 6-32 thd, 1/2 in. lg | 2 |
| 109 | 2190-0006 | Washer, Split lock for no. 6 screw | 8 |
| 110 | 0360-0064 | Board, Terminal | 1 |
| 111 | 00620-624 | Sample Probe Assy | 1 |
| 112 | 00618-632 | Board Assy, Bolometer amplifier | 1 |
| 113 | 3050-0016 | Washer, no. 6, 9/32 in. od, nickel pl brass | 5 |
| 114 | 1400-0016 | Clamp, Cable 9/16 in. dia nylon | 1 |
| 115 | 2950-0002 | Nut, 7/16-20 thd, nickel pl brass | 1 |
| 116 | 2420-0002 | Nut, 6-32 thd x 5/16 in. ss | 2 |
| 117 | 1400-0015 | Clamp, Cable 1/4 in. dia cad pl s | 1 |
| 118 | 2360-0135 | Screw, pan head 6-32 x 1.5, ss. | 3 |
| 119 | 2360-0205 | Screw, machine, 6-32 x 0.75 | 1 |
| 120 | 2190-0018 | Washer, split lock, No. 6 | 3 |
| 121 | 00618-2046 | Board, insulator | 1 |
| 122 | 00618-60107 | Board, Vlt. divider | 1 |

Parts List for Figure I-7

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|------------|-----------------------------------|------|
| 1 | 620A-36AA | Housing | 1 |
| 2 | 00618-204 | Drive Screw and Nut | 1 |
| 3 | 618B-36D | Guide, Frequency | 2 |
| 4 | 618B-36F | Spacer, Rod | 6 |
| 5 | 618B-36L | Retainer, Frequency | 2 |
| 6 | 618B-36AD | Bar, Stop | 1 |
| 7 | 618B-36AE | Spacer, Stop | 3 |
| 8 | 618B-36E | Rod, Connecting | 4 |
| 9 | 618B-36G | Bar, Plunger | 1 |
| 10 | 618B-36AJ | Pin, Link | 2 |
| 11 | 620A-36BB | Plate, Cover | 1 |
| 12 | 00618-2061 | Cavity Assy | 1 |
| 13 | 1410-0009 | Bearing, Ball .75 od .25 bore | 2 |
| 14 | 1460-0041 | Spring, Extension 1.875 in. lg | 2 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|---|------|
| 15 | 2390-0007 | Screw, Bind. head ss 6-32 thd, 5/16 in. lg | 11 |
| 16 | 3050-0066 | Washer, 3/8 in. od 0.147 in. id, brass | 8 |
| 17 | 3050-0014 | Washer, 3/8 in. od 0.26 in. id, bronze | 4 |
| 18 | 2680-0176 | Screw, Hex head ss | 2 |
| 19 | 2190-0034 | Washer | 2 |
| 21 | 0360-0036 | Terminal, Lug, brass angle type | 4 |
| 22 | 2370-0003 | Screw, Flat head ss 6-32 thd, 1/2 in. lg | 6 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|--|------|
| 23 | 1400-0015 | Clamp, Cable 1/4 in. dia, steel | 1 |
| 24 | 2360-0011 | Screw, Round head ss 6-32 thd, 3/4 in. lg | 3 |
| 25 | 2390-0009 | Screw, Bind. head ss 6-32 thd, 3/8 in. lg | 4 |
| 26 | 2190-0007 | Washer, Int lock for no. 6 screw | 3 |
| 27 | 8160-0008 | Braid, RF .25 dia aluminum | 1 |
| 28 | 3030-0001 | Screw, Allen dr set 8-32 thd, 3/16 in. lg | 2 |
| 29 | 618B-36Z | Conductor, Center | 1 |
| 30 | 618B-36AA | Plate, Back | 1 |
| 31 | 618B-36AK | Filter, Repeller assy | 1 |
| 32 | 618B-36BC | Plunger Assy | 1 |
| 33 | 618B-36Y | Ring, Teflon insert | 1 |

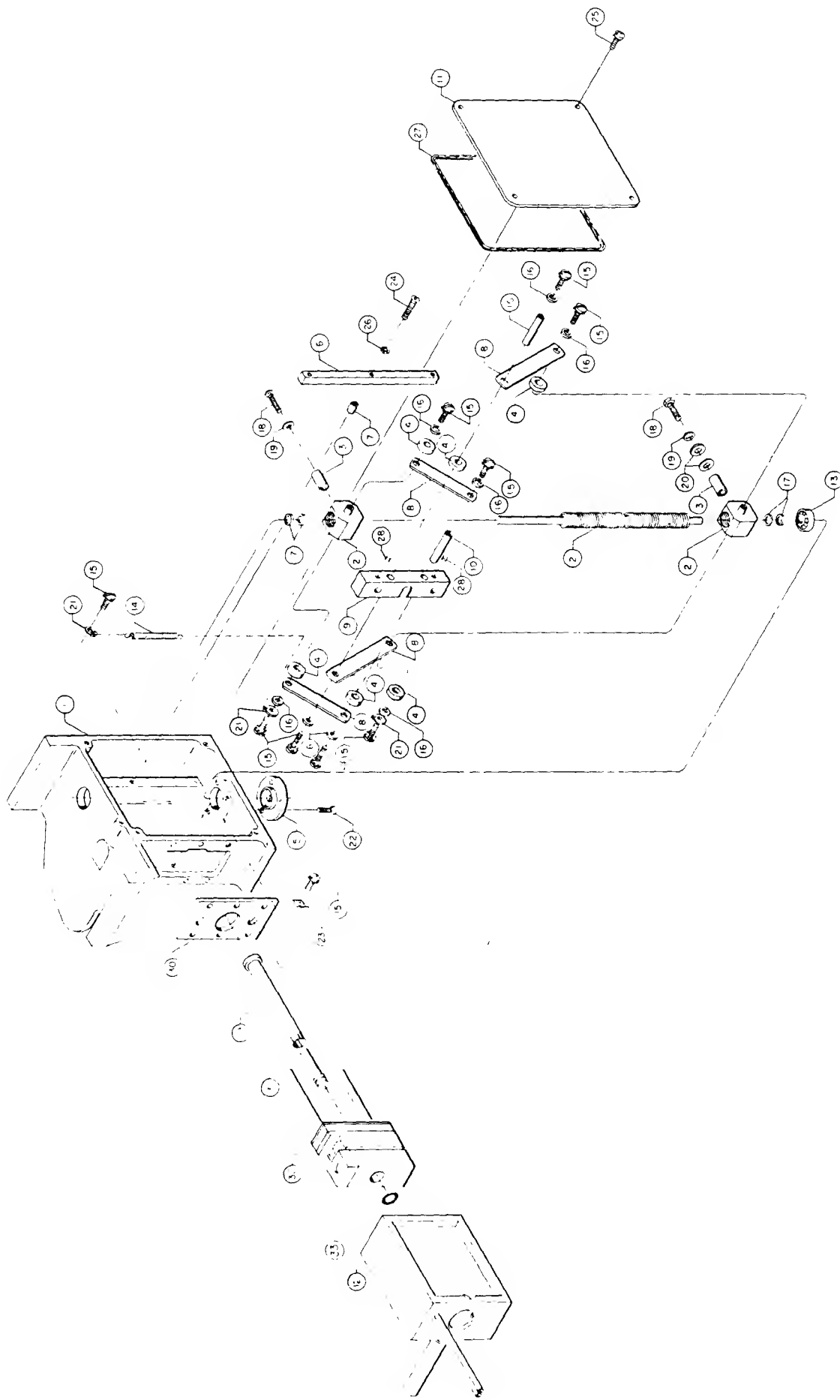


Figure I-7. HP Model 618C S.H.F. Signal Generator, Frequency Drive Mechanism

Parts List for Figure 1-8

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-------------|----------------------------------|------|
| 1 | 620A-36AA | Housing | 1 |
| 2 | 00618-204 | Drive Screw and Nut | 1 |
| 3 | 618B-36D | Guide, Frequency | 2 |
| 4 | 618B-36F | Spacer, Rod | 4 |
| 5 | 618B-36L | Retainer, Frequency | 2 |
| 6 | 618B-36AD | Bar, Stop | 1 |
| 7 | 618B-36AE | Spacer, Stop | 3 |
| 8 | 620A-36C | Rod, Connecting | 4 |
| 9 | 620A-36D | Bar, Plunger | 1 |
| 10 | 620A-36F | Pin, Plunger | 2 |
| 11 | 620A-36G | Plate, Drive | 1 |
| 12 | 00620-20049 | Conductor, Center | 1 |
| 13 | 620A-36J | Plunger Assy | 1 |
| 14 | 620A-36L | Pin, Link | 1 |
| 15 | 620A-36BB | Plate, Cover | 1 |
| 16 | 1410-0009 | Bearing, Ball .75 od .25 bore | 2 |
| 17 | 00620-243 | Cavity Assy | 1 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|------------|--|------|
| 18 | 1460-0041 | Spring, Extension 1.875 lg | 2 |
| 19 | 2220-0005 | Screw, Fil head ss, 4-40 thd, 5/8 in. lg | 2 |
| 20 | 2390-0007 | Screw, Bind. head ss, 6-32 thd, 5/16 in. lg | 9 |
| 21 | 3050-0066 | Washer, 3/8 in. od 0.147 in. id, brass | 6 |
| 22 | 3030-0030 | Screw, Allen dr cap 6-32 thd, 1 in. lg | 1 |
| 23 | 3050-0014 | Washer, 3/8 in. od 0.26 in. id, bronze | 4 |
| 24 | 00620-0176 | Screw, Hex head ss, 10-24 thd, 3/4 in. lg | 2 |
| 25 | 2190-0034 | Washer | 2 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|---|------|
| 27 | 0360-0036 | Terminal lug brass angle type | 4 |
| 28 | 2370-0003 | Screw, Flat head ss, 6-32 thd, 1/2 in. lg | 6 |
| 29 | 1400-0054 | Clamp, Cable 1/8 in. dia, steel | 1 |
| 30 | 3030-0007 | Screw, Allen dr set 4-40 thd, 1/8 in. lg | 4 |
| 31 | 2360-0011 | Screw, Round head ss, 6-32 thd, 3/4 in. lg | 3 |
| 32 | 2390-0009 | Screw, Bind. head ss, 6-32 thd, 3/8 in. lg | 4 |
| 33 | 2190-0007 | Washer, Int lock for no. 6 screw | 3 |
| 34 | 8160-0008 | Braid, RF .25 dia aluminum | 1 |
| 35 | 620A-36M | Filter, Repeller | 1 |

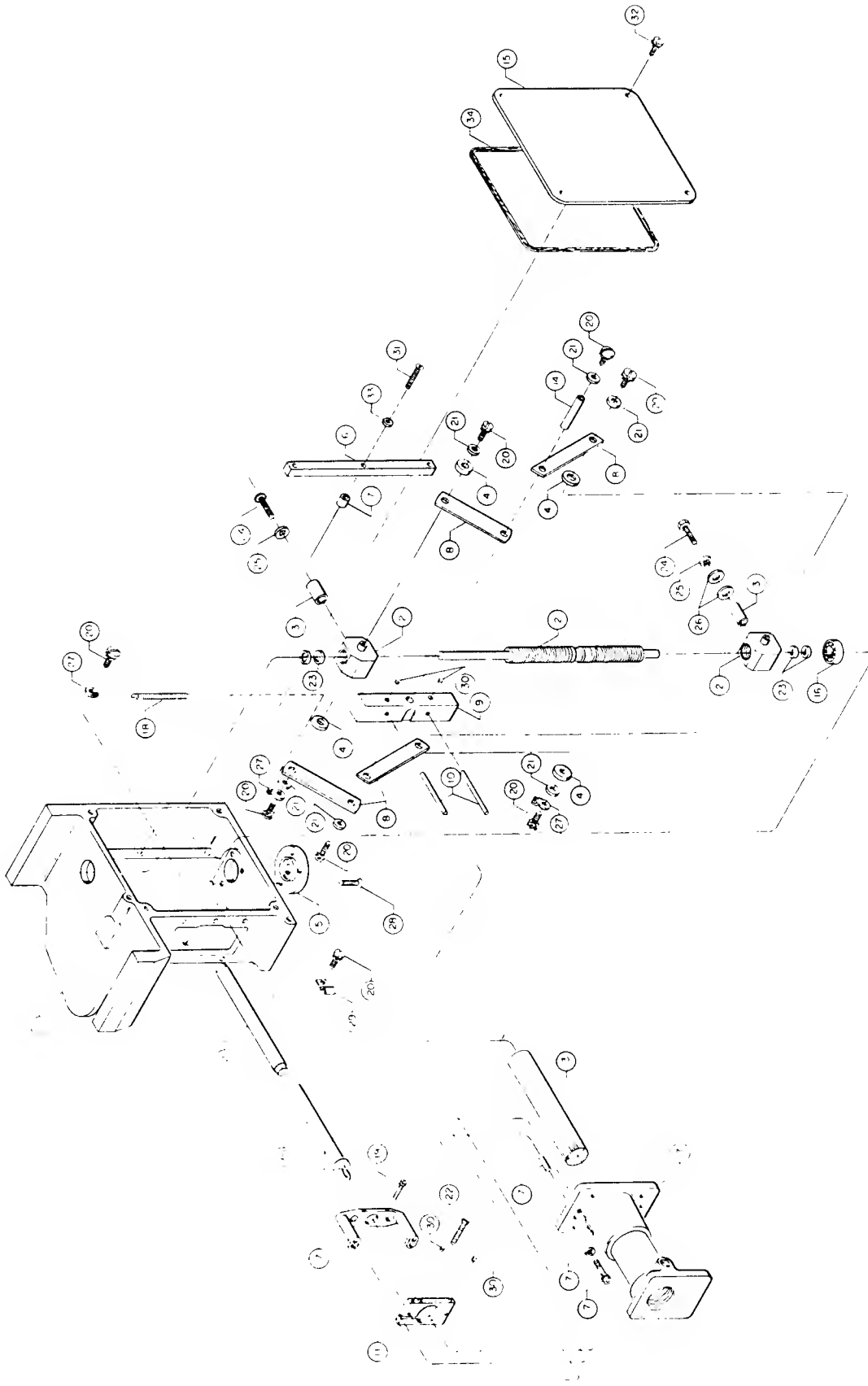


Figure I-8. HP Model 620B S.H.F. Signal Generator, Frequency Drive Mechanism

Parts List for Figure I-9

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|---------------|------|
| 1 | | See Figure 10 | |
| 2 | | See Figure 11 | |
| 3 | | See Figure 12 | |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|-------------|------|
| | | | |
| | | | |
| | | | |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|-------------|------|
| | | | |
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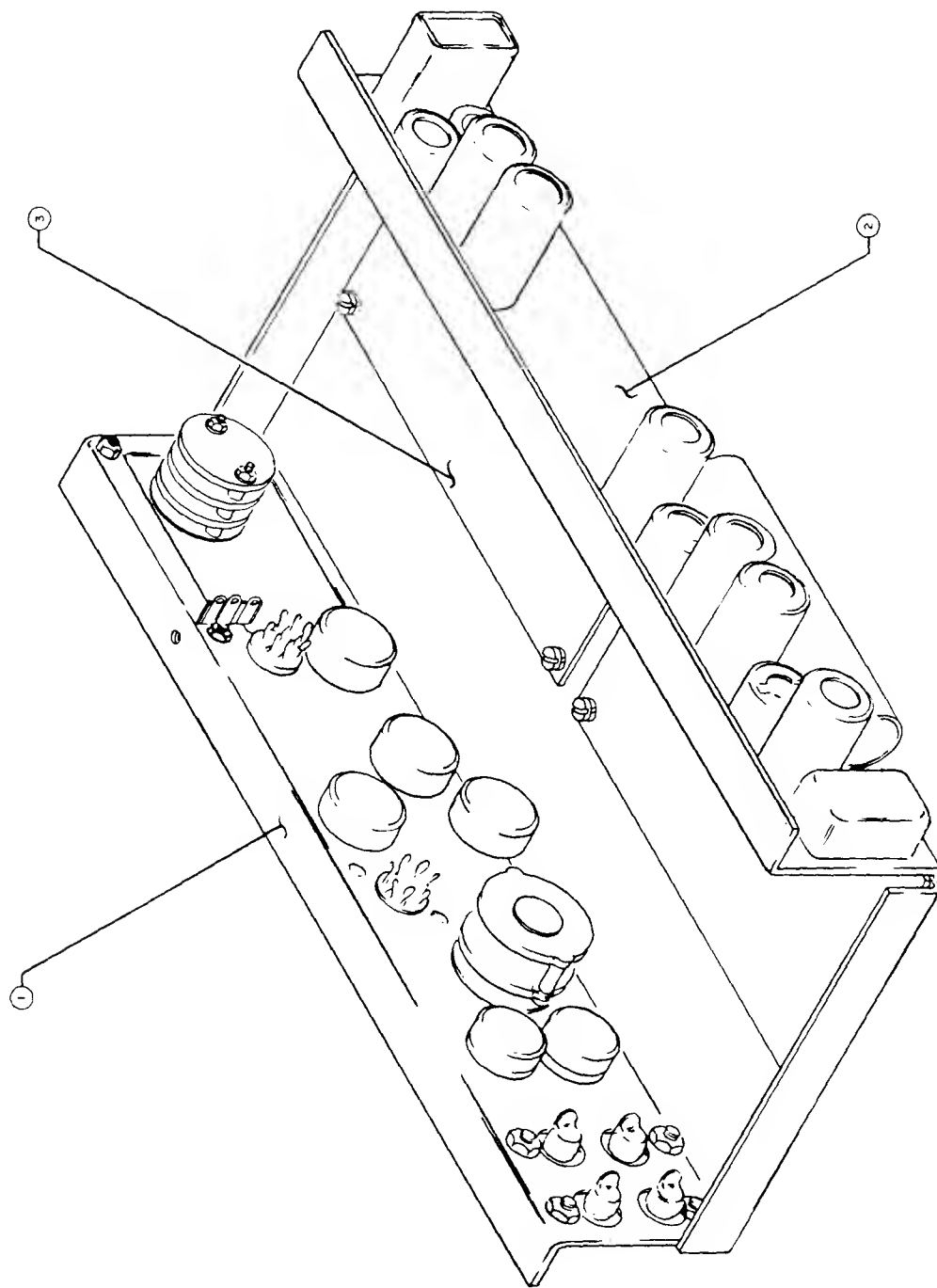


Figure I-9. HP Model 618C/620B S. H. F. Signal Generator, Pulser Section Index

Parts List for Figure I-10

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|------------|--|------|
| 1 | 2950-0001 | Nut, 1/2 in. wide 3/8-32 thd, br | 8 |
| 2 | 2190-0006 | Washer, Split lock for no. 6 screw | 5 |
| 3 | 3050-0066 | Washer, 3/8 in. od 0.147 in. id, brass | 5 |
| 4 | 2190-0022 | Washer, Int. lock 11/16 in. od | 8 |
| 5 | 3100-0076 | Switch, Rotary 4 sect, 8 pos | 1 |
| 6 | 00618-0055 | Plate, switch | 1 |
| 7 | 1200-0003 | Socket, 9 pin tube | 2 |
| 8 | 3100-0075 | Switch Rotary 2 sect, 5 pos | 1 |
| 9 | 2390-0010 | Screw, B. H. ss 6-32 x .5 | 4 |
| 10 | 2420-0001 | Nut, 5/16 in. wide ss 6-32 thd, w/lock | 9 |
| 11 | 2100-0025 | Resistor, Variable 1.5K ohms, 10%, 2.25 w | 1 |
| 12 | 2100-0059 | Resistor, Variable 3 x 1 meg ohms 10% 2 w | 1 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|---|------|
| 13 | 2100-0051 | Resistor, Variable 20K ohms, 10%, 1.12 w | 1 |
| 14 | 2100-0047 | Resistor, Variable 1 meg ohm 20% 1.12 w | 1 |
| 15 | 2100-0029 | Resistor, Variable 250K ohms, 10%, 2.25 w | 2 |
| 16 | 2190-0008 | Washer, Ext lock for no. 6 screw | 5 |
| 17 | 0160-0081 | Capacitor, Fxd paper 0.25 uf 10% 1K vdcw | 2 |
| 18 | 2390-0009 | Screw, Bind. head ss, 6-32 thd, 3/8 in. lg | 5 |
| 19 | 2950-0033 | Nut, 1/2 in. wide, 3/8-32 thd, br | 3 |
| 20 | 5020-0238 | Head, Coupler 3/4 in. dia | 4 |
| 21 | 3030-0001 | Screw, Allen dr set 8-32 thd, 3/16 in. lg | 10 |
| 22 | 1932-0046 | Tube, Electron 12AU7 | 2 |
| 23 | 1220-0009 | Shield, Tube 9 pin 1-15/16 in. h | 2 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|-----------------------------------|------|
| 24 | 618B-16S | Cable Assy | 1 |
| 25 | 618B-52 | Socket Assy | 1 |
| 28 | 1400-0031 | Clamp, Cable 3/8 in. dia nylon | 1 |
| 29 | 0360-0015 | Strip, 3 terminal 2 ins 1 gnd | 1 |
| 31 | 5040-0224 | Head, Coupler | 1 |
| 36 | 0360-0031 | Lug, Terminal for no. 6 screw | 1 |

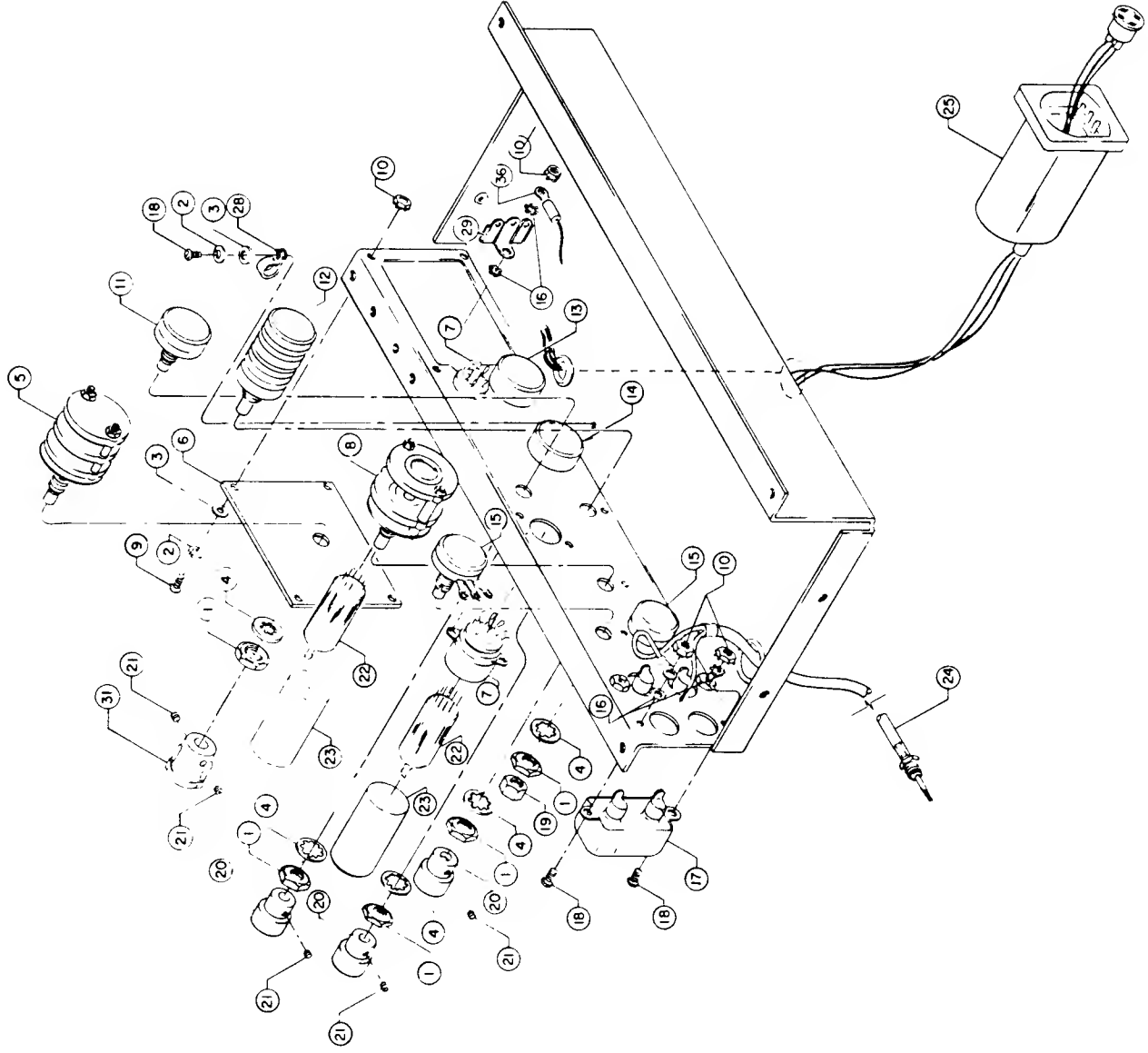


Figure I-10. HP Model 618C/620B S.H.F. Signal Generator, Partial Rear View, Pulsar Section

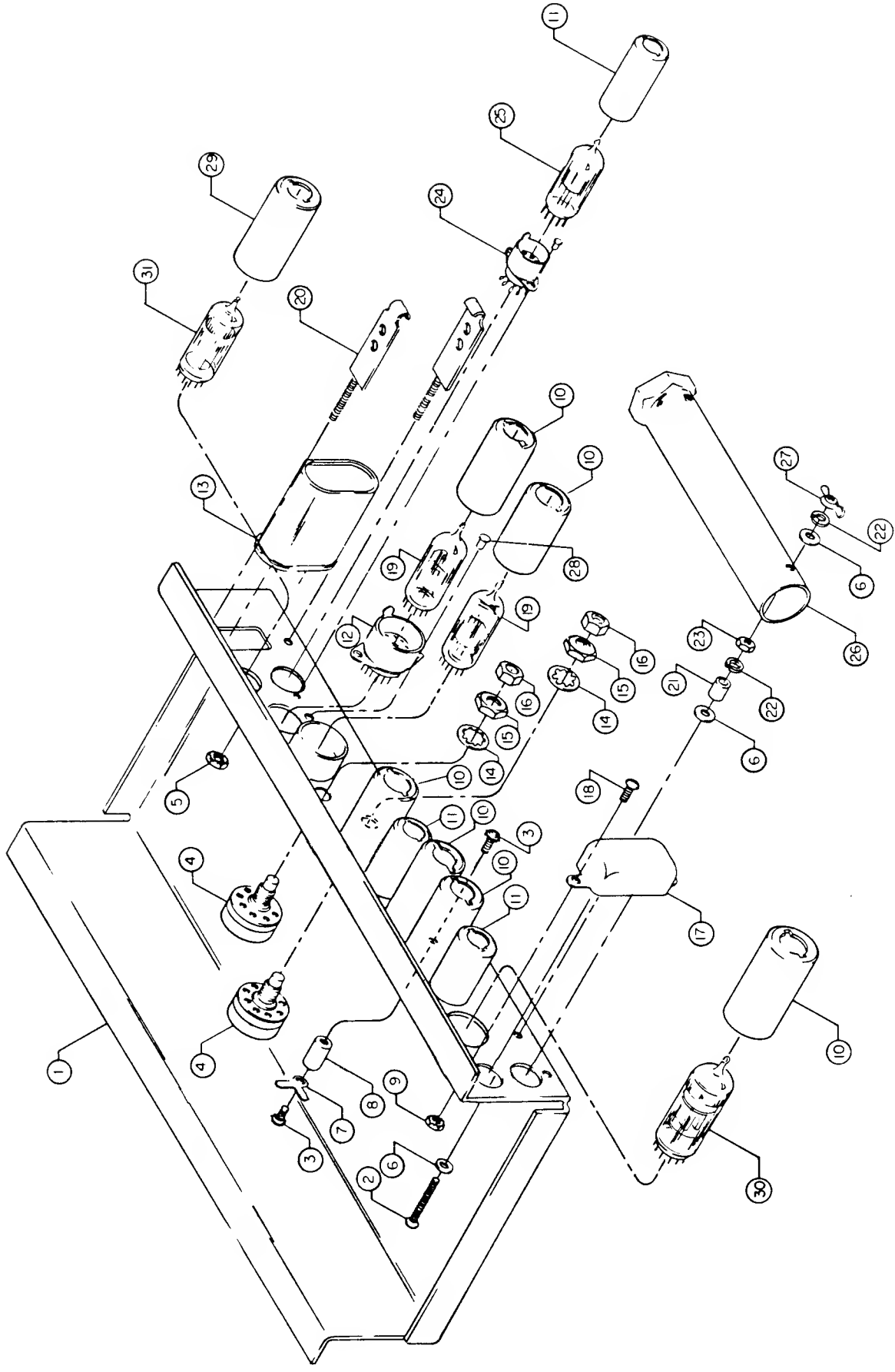


Figure I-11. HP Model 618C/620B S.H.F. Signal Generator, Partial Rear View, Pulser Section

Parts List for Figure I-13

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|--|------|
| 1 | 0160-0102 | Capacitor, Fxd paper 4 uf 10% 1K vdcw | 3 |
| 2 | 0180-0128 | Capacitor, Fxd electro- lytic 2800 uf 30 vdcw | 1 |
| 3 | 0180-0024 | Capacitor, Fxd electro- lytic 40 uf 450 vdcw | 5 |
| 4 | 00618-022 | Chassis, Power | 1 |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|-------------|------|
| | | | |
| | | | |
| | | | |
| | | | |

| REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-----------|-------------|------|
| | | | |
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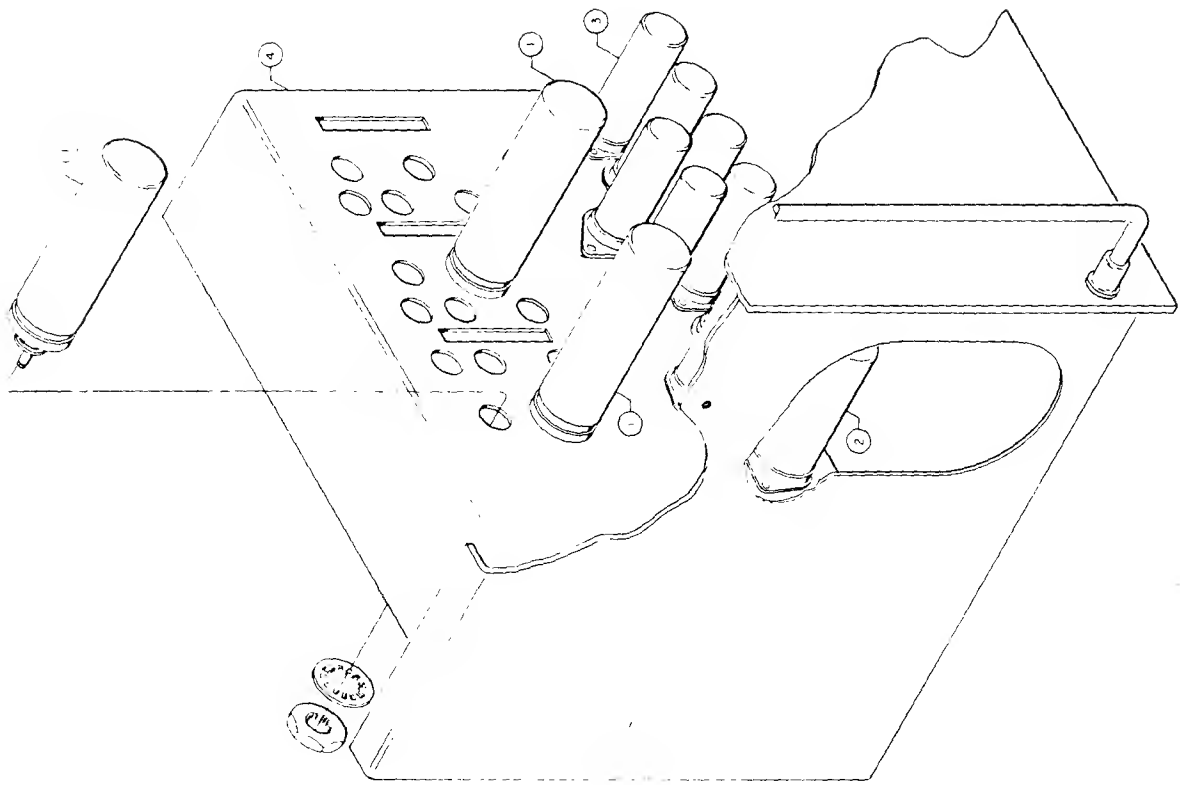


Figure I-13. HP Model 618C/620B S. H. F. Signal Generator, Chassis, Front View

Parts List for Figure I-14

| REF. | STOCK NO. | DESCRIPTION | QTY. | REF. | STOCK NO. | DESCRIPTION | QTY. | REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|------------|---|------|------|------------|---|------|------|------------|--|------|
| 1 | 00618-6060 | Board Assy, -300 VPS | 1 | 23 | 2420-0003 | Nut, 1/4 in. wide, 6-32 thd | 2 | 44 | 1251-1037 | Connector, 7 contact male cable plug | 1 |
| 2 | 00618-6061 | Board Assy, -1000 VPS | 1 | 24 | 9100-2887 | Filter, Line | 1 | 45 | 1251-1039 | Ring, Lock | 1 |
| 3 | 00618-6062 | Board Assy, -1550 VPS | 1 | 25 | 2550-0007 | Screw, Bind. head ss, 8-32 thd, 3/8 in. lg w/ext lock | 2 | 46 | 1251-1040 | Spring, Lock | 1 |
| 4 | 9100-1703 | Transformer, Power | 1 | | | | | 47 | 1251-1041 | Hood, Insulating | 1 |
| 5 | 2940-0005 | Screw, Truss head ss, 1/4-20 thd, 3/4 in. lg | 4 | 26 | 2580-0003 | Nut, 11/32 in. wide, 8-32 thd, w/lock | 2 | 48 | 1251-0194 | Connector, 15 contact printed circuit type | 3 |
| 6 | 2190-0032 | Washer, Split lock for 1/4-20 screw | 4 | 27 | 0360-0015 | Strip, 3 terminal, 2 ins, 1 gnd | 1 | | | | |
| 7 | 2950-0004 | Nut, 7/16 in. wide, 1/4-20 thd ss | 4 | 28 | 2270-0001 | Screw, Bind. head ss, 6-32 thd, 5/16 in. lg | 1 | | | | |
| 8 | 00618-030 | Bracket, Transformer support | 1 | 29 | 2190-0004 | Washer, Int lock for no. 4 screw | 2 | | | | |
| 9 | 2990-0002 | Screw, Truss head ss, 10-24 thd, 1/2 in. lg | 31 | 30 | 2260-0002 | Nut, 3/16 in. wide, 4-40 thd | 1 | | | | |
| 10 | 2980-0002 | Nut, 3/8 in. wide, 10-24 thd, w/lock | 10 | 31 | 2110-0003 | Fuse, Cartridge 3.0 amp | 1 | 53 | 00618-031 | Gusset, Right | 1 |
| | | | | | | | | 54 | 00618-0053 | Gusset, Left | 1 |
| 12 | 2550-0007 | Screw, Bind. head ss, 8-32 thd, 3/8 in. lg w/lock | 1 | 32 | 2110-0338 | Fuse, Cartridge 1.6 amp | 1 | 55 | 2520-0017 | Screw, Round head ss, 6-32 thd, 2-3/4 in. lg | 1 |
| 13 | 2190-0010 | Washer, Ext lock for no. 8 screw, .851 in. od | 1 | 33 | 1400-0084 | Fuseholder, Post type 2-5/64 in. lg | 1 | 56 | 3050-0071 | Washer, no. 8, 7/16 in. od, cad pl brass | 2 |
| 14 | 2580-0003 | Nut, 11/32 in. wide, 8-32 thd, w/ext lock | 1 | 34 | 1251-1036 | Connector, 7 contact female | 1 | 57 | 3050-0006 | Washer, no. 10, 1/2 in. od, fibre | 2 |
| 15 | 2520-0019 | Screw, Round head ss, 8-32 thd, 4-1/2 in. lg | 1 | | | | | 58 | 2190-0017 | Washer, Split lock for no. 8 screw | 1 |
| | | | | | | | | 59 | 2580-0004 | Nut, 8-32 thd x 11/32 in. ss | 1 |
| 17 | 2580-0003 | Nut, 11/32 in. wide, 8-32 thd, w/ext lock | 1 | 35 | 2190-0034 | Washer, Split lock for no. 10 screw | 21 | 60 | 3050-0019 | Washer, no. 10, 1/2 in. od, nickel pl brass | 4 |
| | | | | 36 | 1251-2357 | Connector, 3 contact ac power receptacle | 1 | 61 | 2980-0001 | Nut, 10-24 thd x 3/8 in. ss | 4 |
| | | | | 37 | 3101-1234 | Switch, Slide DPDT | 1 | 62 | 2950-0038 | Nut, 1/2-24 thd x 11/16 in., cad pl s | 2 |
| | | | | 38 | 618B-12D | Bracket, Cabinet | 2 | 63 | 2190-0037 | Washer, Int lock for 1/2 in. screw | 2 |
| 20 | 2360-0011 | Screw, Round head ss, 6-32 thd, 3/4 in. lg | 1 | 39 | 618B-12E | Bracket, Cabinet | 2 | 64 | 0900-0016 | O-ring, Rubber 1/2 in. id, 11/16 in. od | 1 |
| 21 | 2190-0006 | Washer, Split lock for no. 6 screw | 2 | 40 | 00618-0056 | Gusset, Extension | 2 | | | | |
| 22 | 3050-0016 | Washer, no. 6, 9/32 in. od, brass | 2 | 41 | 5040-0601 | Guide, Circuit board 2-1/2 in. lg | 6 | | | | |
| | | | | 42 | 00618-0050 | Deck, Voltage Regulator | 1 | | | | |
| | | | | 43 | 3050-0226 | Washer, 0.438 in. od, 0.195 in. id, ss | 4 | | | | |

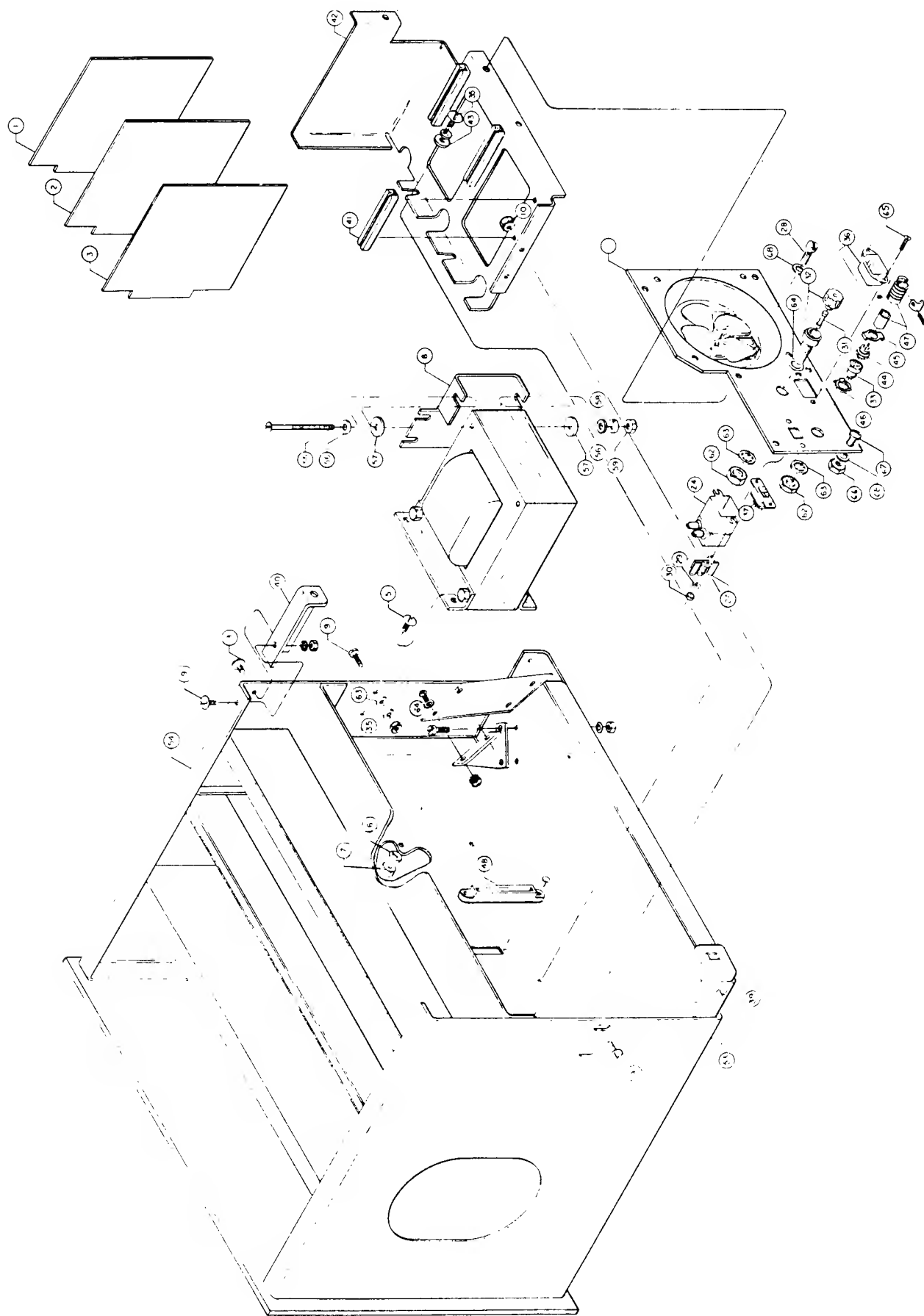


Figure I-14. HP Model 618C/620B S.H.F. Signal Generator, Chassis, Rear View

Parts List for Figure I-15

| REF. | STOCK NO. | DESCRIPTION | QTY. | REF. | STOCK NO. | DESCRIPTION | QTY. | REF. | STOCK NO. | DESCRIPTION | QTY. |
|------|-------------|---|------|------|-----------|-------------|------|------|-----------|-------------|------|
| 1 | 00618-60099 | Cabinet Assembly | 1 | | | | | | | | |
| | 00618-6063 | Cabinet Assembly. Rack | 1 | | | | | | | | |
| 2 | 5020-7433 | Captive Screw Assy (Cabinet Model only) | 4 | | | | | | | | |
| 3 | 3150-0005 | Filter, Air | 1 | | | | | | | | |
| 4 | 2940-0039 | Screw, Pozidrive (Not shown. Rack Models only.) | 4 | | | | | | | | |

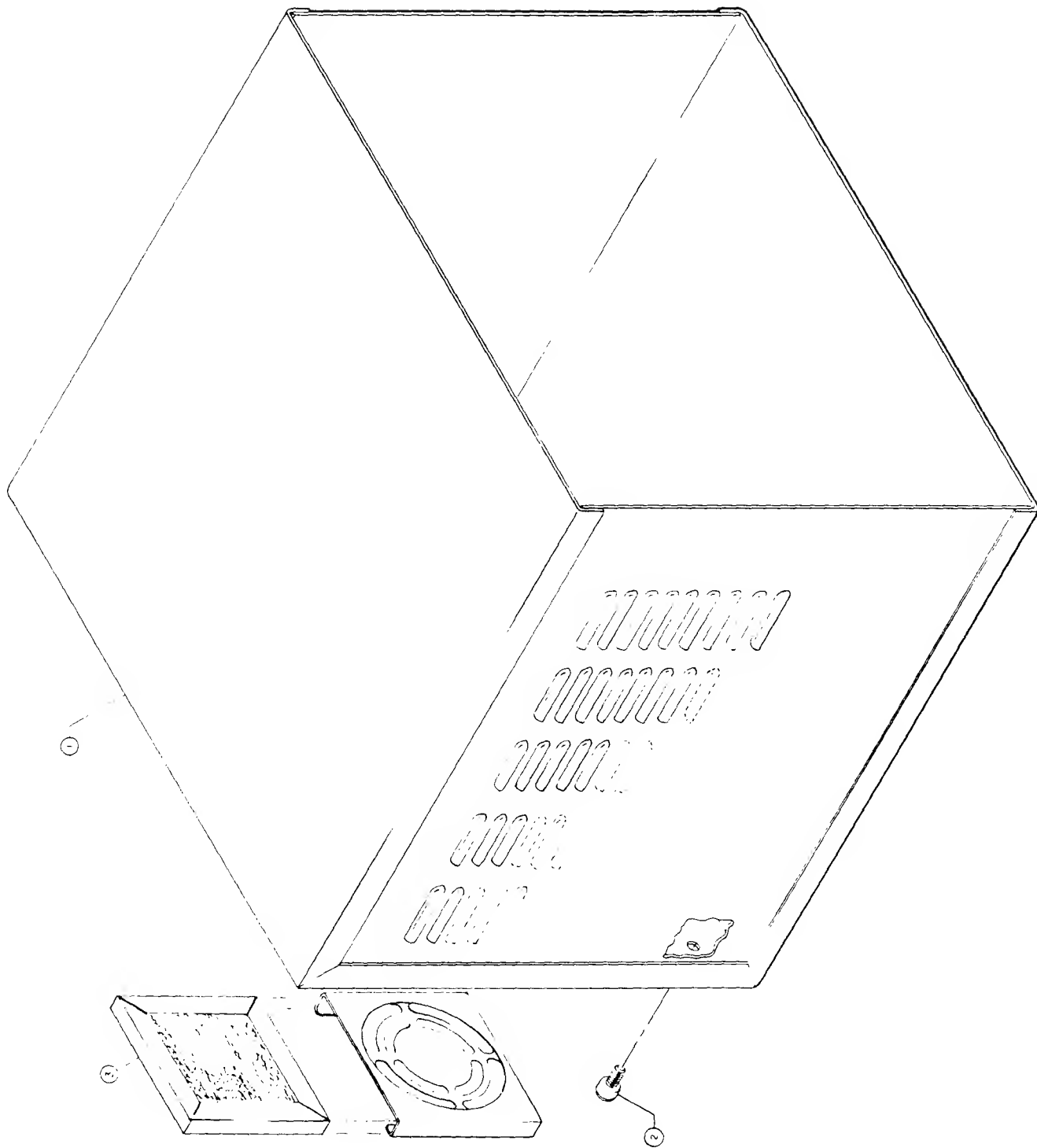


Figure I-15. HP Model 618C/620B S.H.F. Signal Generator, Dust Cover

APPENDIX II

MANUAL CHANGES

INTRODUCTION

This section contains information for adapting this manual to instruments for which the content does not apply directly. In addition, information about recommended modifications for improvements to the instrument is provided.

MANUAL CHANGES

To adapt this manual to your instrument, refer to Table II-1 (618C) or Table II-2 (620B) and make all of the manual changes listed opposite your instrument serial number or prefix. Perform these changes in reverse-alphabetical order (for example, change C, then B, then A).

If your instrument serial number or prefix is not listed on the title page of this manual, or in Tables II-1 or II-2, it may

be documented in a yellow MANUAL CHANGES supplement. For additional information about serial number coverage refer to INSTRUMENT IDENTIFICATION in Section I of this manual.

INSTRUMENT IMPROVEMENT MODIFICATIONS

Some instrument modifications are recommended in this section (for example, for improved performance, reliability, or parts availability). These instrument modifications are not the same as manual changes that change this manual to apply directly to your instrument. Be aware also, that instrument modifications lessen the significance of the serial number prefix and nullify the need for corresponding manual changes.

Table II-1. 618C Manual Changes By Serial Number

| Serial Prefix or Number | Make Manual Changes |
|-----------------------------|---------------------|
| 630- | A-T,V |
| 645-00176 to 645-00200 | B-T,V |
| 702-00201 to 702-00210 | C-T,V |
| 702-00211 to 702-00278 | D-T,V |
| 716- | E-T,V |
| 740-00701 to 740-00725 | F-T,V |
| 740-00726 to 740-01250 | G-T,V |
| 915- | H-T,V |
| 934-01376 to 934-01500 | I-T,V |
| 934-01501 to 934-01525 | J-T,V |
| 963- | K-T,V |
| 979-, and 0979A to 01765 | L-T,V |
| 0979A01766 and above | M-T,V |
| 1133A | N-T,V |
| 1201A | O-T,V |
| 1228A01991 to 02080 | P-T,V |
| 1228A02081 to 02110 | Q-T,V |
| 1311A | R-T,V |
| 1441A, 1448A | S,T,V |
| 1518A | T,V |
| 1546A | V |

Table II-2. 620B Manual Changes By Serial Number

| Serial Prefix or Number | Make Manual Changes |
|--------------------------|---------------------|
| 633- | A-V |
| 645-00151 to 645-00175* | B-V |
| 645-00176 to 645-00200** | D-V |
| 718- | E-V |
| 740- | G-V |
| 911- | H-V |
| 935-01151 to 935-01225 | I-V |
| 935-01226 to 935-01250 | J-V |
| 963- | K-V |
| 985-, and 0985A | L-V |
| 1134A | M-V |
| 1201A | O-V |
| 1231A01786 to 01860 | P-V |
| 1231A01861 to 01890 | Q-V |
| 1312A | R-V |
| 1443A, 1447A | S-V |
| 1517A | T-V |
| 1546A | V |

*Excluding 645-00156, 645-00163, and 645-00165.

**Including 645-00156, 645-00163, and 645-00156

CHANGE A

Page 5-37/5-38, Figure 5-31:

Change R513 to 562K.

Page 6-4, Table 6-2:

Change R513 to 0757-0790 RESISTOR 562K 1% 0.25W F TC=0±100.

CHANGE B

Page 6-8, Table 6-2:

Change S1 to 3101-0107 SWITCH, PUSHBUTTON.

CHANGE C

Change CR401 and CR402 to 1901-0036 DIODE-HV RECT 1 KV 600 MA DO-29.

NOTE

The recommended replacement for CR401 and CR402, however, is diode 1901-0487 (not 1901-0036).

CHANGE D

Page 5-37/5-38, Figure 5-31:

Change R360 to 18 ohms.

Change R372 to 15K.

Page 6-3, Table 6-2:

Change R360 to 0693-1801 RESISTOR 18 OHMS 10% 2W CC TC=0+412.

Change R372 to 0693-1531 RESISTOR 15K 10% 2W CC TC=0+765.

CHANGE E

Page 5-37/5-38, Figure 5-31:

Change R374 to 1.21M.

Page 6-3, Table 6-2:

Change R374 to 0757-0871 RESISTOR 1.2M 1% 0.5W F TC=0±100.

CHANGE F

Page 5-31/5-32, Figure 5-28:

Delete asterisk (*) from R701 (not a factory selected part; the value shown is the actual value).

CHANGE G

Page 6-4, Table 6-2:

Change the part numbers for A700 and A800 as shown below:

A700 (618C) 00618-6059

A700 (620B) 00620-6027

A800 (both) 00618-6058

CHANGE H

Page 5-26, Figure 5-23:

Replace figure with attached photo.

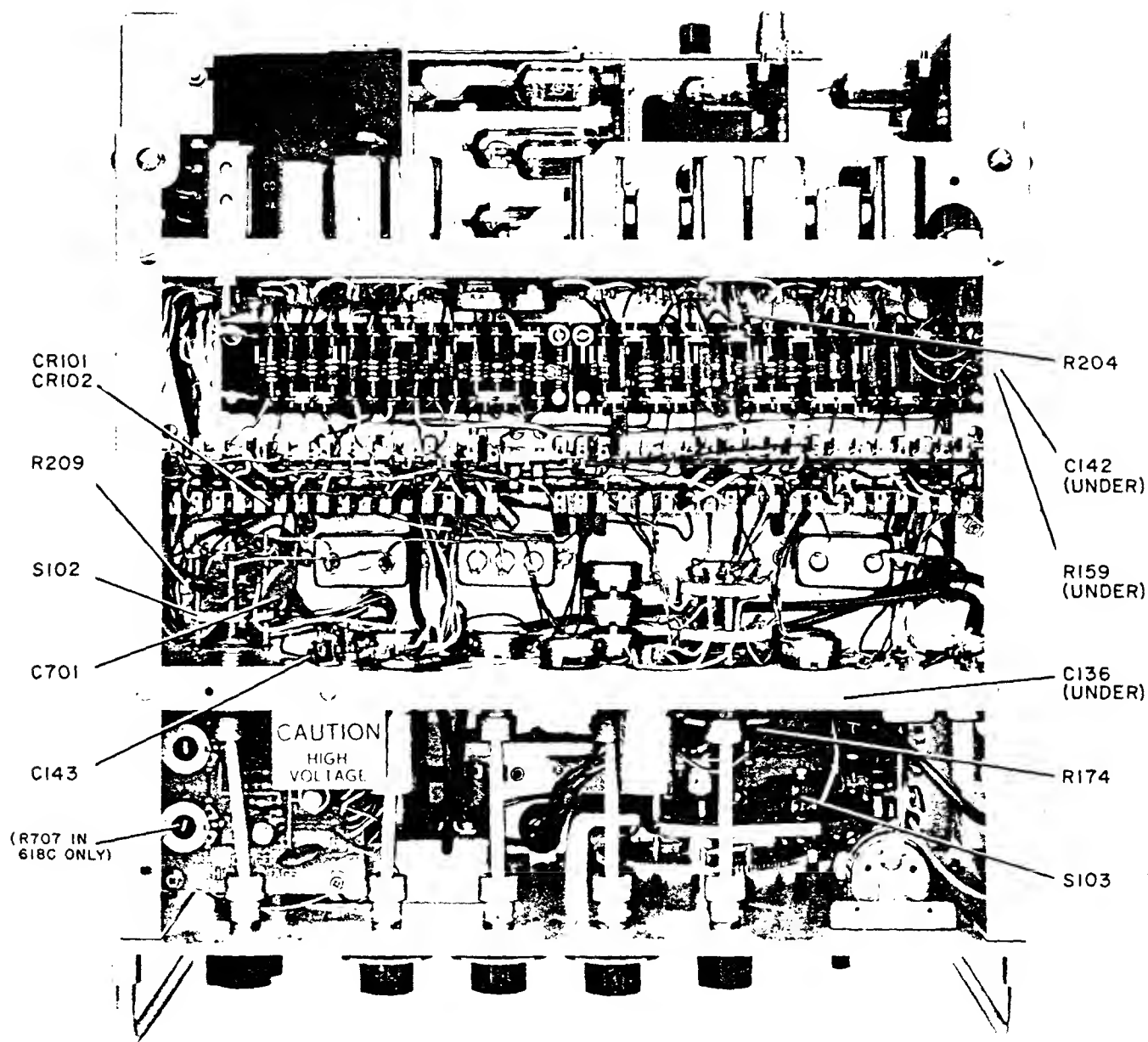


Figure II-1. Interior View Showing Locations of Unlabeled Chassis Components, Top View, (P/O Change H)

CHANGE I

Page 6-8, Table 6-2:

Change S1 to 3101-0100 SWITCH-PB SPDT ALTNG 5A 115 VAC.

CHANGE J

Page 6-7, Table 6-2:

Change FL301 to 9110-0014 FILTER, LINE.

Change J301 to 1251-0148 CONNECTOR-AC PWR HP-8 MALE FLG-MTG.

Page 6-9, Table 6-2:

Change the power cable, 8120-1378, to 8120-0078 CABLE ASSEMBLY 18 AWG 3-CONDCT BLK-JKT 0.25-OD.

CHANGE K

Page 5-31/5-32, Figure 5-28:

Delete diode CR103.

Page 6-7, Table 6-2:

Delete CR103.


CHANGE L

Page 6-4, Table 6-2:

Change R612 to 2100-0898.

CHANGE M

Page 5-33/5-34, Figure 5-29:

At the junction R159-C143, delete the reference “—300V FROM A800 . . . ”; replace it with  (—300V).

Page 5-35, Figure 5-30:

Delete C145, R211, and the reference to —300V from A800, etc. On S102E, connect switch position 7 to a corresponding position 7 on S102G.

Page 6-7, Table 6-2:

Delete C145.

Page 6-8, Table 6-2:

Delete R211.

Page 6-9, Table 6-2:

Delete cable 618B-16L.

CHANGE N

Page I-4, Parts List for Figure I-2:

Change items 49, 50, and 51 as follows:

49. 618B-40B Cover, Frequency Dial

50. 61B-40B-1 Cover, Attenuator Dial

51. 00618-020 Panel, Front

00618-021 Panel, Front (rack mtg).

NOTE

These parts are no longer stocked by Hewlett-Packard but can be special ordered. The corresponding parts, listed in the manual and currently stocked, differ only in color.

CHANGE N (Cont'd)

Page I-32, Parts List for Figure I-15:

Change the stock number for item 1 to 00618-6056.

CHANGE O

Page 5-37/5-38, Figure 5-31:

Replace appropriate portion of schematic with the attached partial schematic:

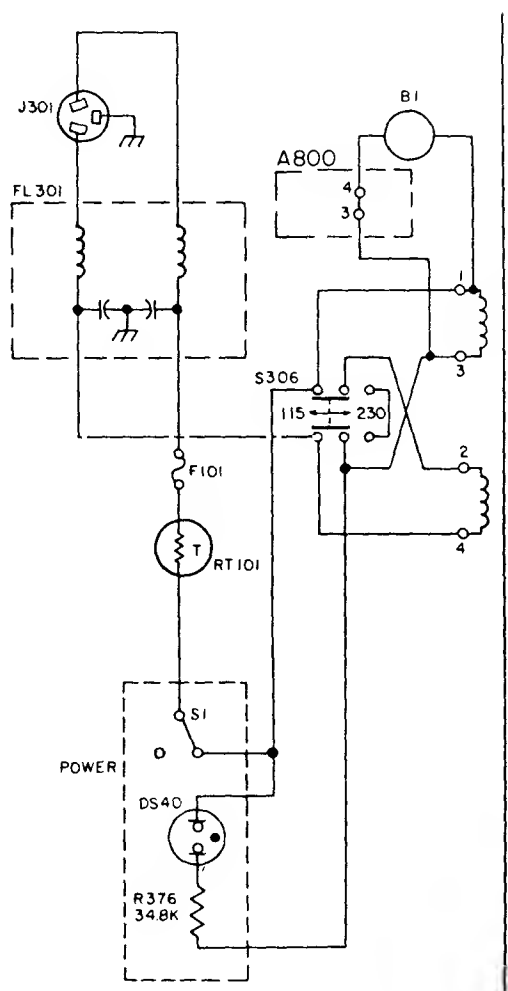


Figure II-2. Partial Schematic for Power Supply Section (P/O Change O)

CHANGE P

Page 5-33/5-34, Figure 5-29:

Change R134* to 3900Ω (typical value only).

Page 6-5, Table 6-2:

Change R134 to 0690-3921 R:FXD COMP 3900 OHM 10% 1W (typical value only).

CHANGE Q

Page 6-6, Table 6-2:

Change C142 to 0160-0088 C:FXD PAPER 0.25 UF 10% 1500 VDCW.

Page 6-6, Table 6-2:

Change C136 to 0160-0088 C:FXD PAPER 0.25 UF 10% 1500 VDCW.

Change C407, C508, and C509 to 0160-0102 C:FXD PAPER 4 UF 10% 1000 VDCW.

CHANGE R

Page 5-5 (Adjustments):

Replace the filament voltage adjustment with the following instruction.

6.3 Vdc FILAMENT VOLTAGE ADJUSTMENT

WARNING

HIGH VOLTAGE. Measurement points used in this procedure (pins 23 through 28) have 1000 volts potential to chassis. Use extreme care when making the filament voltage measurement. The use of a battery powered voltmeter with a plastic case (such as a Simpson 260) is recommended for this measurement. Do not use an ac powered instrument unless the common can be floated at 1000 Vdc and is isolated from the external chassis.

Adjust potentiometer R801 for 6.3 Vdc between pins 25 and 26 (not that pins 23, 24, and 25 are common; pins 26, 27 and 28 are common).

Page 5-31/5-32, Figure 5-28:

Change the pin references for “-300V from A800” to pins 9-12 (3 places).

Change the pin references for “-1550V from A800” to pins 13-15 (2 places).

Page 5-35, Figure 5-30:

Change the pin references for “-300V from A800” to pins 9-12 (2 places).

Page 5-37/5-38, Figure 5-31:

Replace component identification photo for A800 with the following photo:

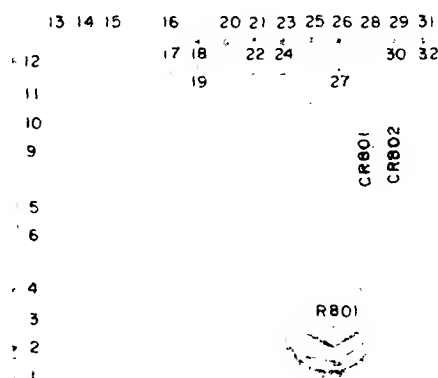


Figure II-3. Component Identification, A800 (P/O Change R)

CHANGE R (Cont'd)

Make the following changes to the schematic:

- Add the filament for V701 across pins 3 and 4 of A500.
- Change the pin references for “-300V to A800” to pins 9-12 (at test point 2).
- Change pin references for “-1550V to A800” to pins 13-15 (at test point 9).
- Replace appropriate portion of the schematic with the attached partial schematic.

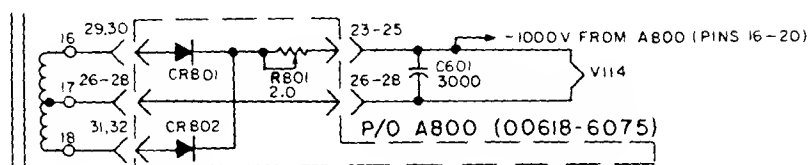


Figure II-4. Partial Schematic for Power Supply Section (P/O Change R)

Pages 6-4 and 6-5, Table 6-2:

Delete the entire A800 assembly parts list; add the following parts in its place.

A800 00618-6075 BOARD ASSEMBLY, INTERCONNECTION

CR801, CR802 1901-0026 DIODE SILICON, 0.75A 200 PIV

R801 2100-0308 R:VAR 2 OHM 10% LIN 5W

Page 6-7, Table 6-2:

Delete Q1.

Page 6-9, Table 6-2:

Delete bracket 00618-00075, and insulator 0340-0875.

CHANGE S

Page 5-37/5-38, Figure 5-31:

Replace component identification photo for A800 with the following photo.

On the schematic, delete diode CR804; connect CR803 to VR801.

On the schematic, delete diode CR805; connect together VR801, R802, and the base of Q802.

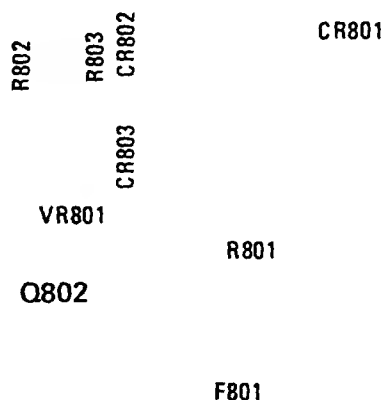


Figure II-5. Component Identification, A800 (P/O Change S)

CHANGE S (Cont'd)

Page 6-4, Table 6-2:

Delete CR804 and CR805.

Page 6-7, Table 6-2:

Delete the following parts under F101:

2110-0470

1400-0090

2110-0465

2110-0467

Add the following part number in their place:

1400-0084

NOTE

If any part of the old fuseholder (1400-0084) needs replacing, all four parts of the new fuseholder must be ordered. The old fuseholder can be identified by a straight solder lug to which the white-black-gray wire attaches. On the new fuseholder the solder lug is at a right angle to the body.

Page I-10, Parts List for Figure I-5:

Add the following items:

17. 00618-238 Adapter

57. 2190-0016 Washer, Int lock, 1/2 in. od

58. 2950-0001 Nut, 1/2 in. wide 3/8-32 thd, br.

Page I-12, Figure I-5:

Replace appropriate portion of figure with the attached partial view.

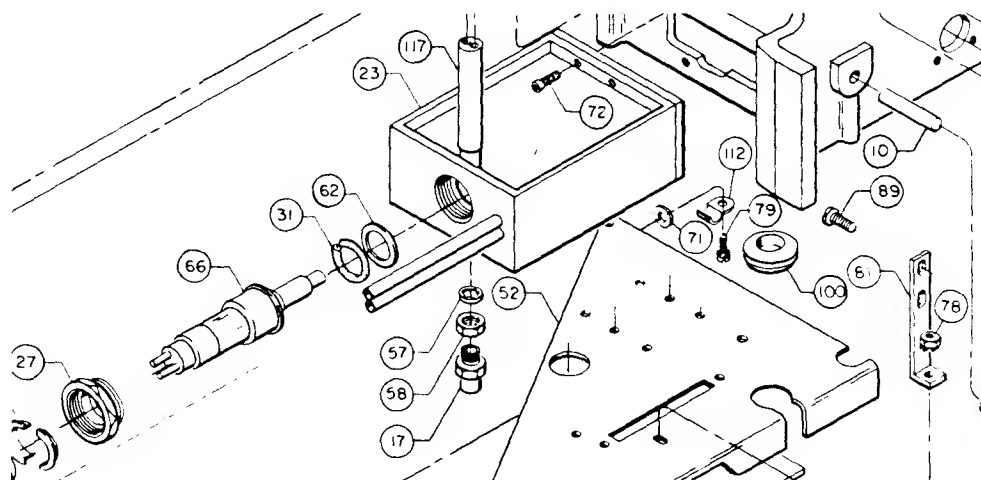


Figure II-6. HP Model 618C S.H.F. Signal Generator, Klystron Assembly and Drive Mechanism
(partial view, P/O Change S)

CHANGE T

Page 5-37/5-38, Figure 5-31:

Replace appropriate portion of schematic with the attached partial schematic.

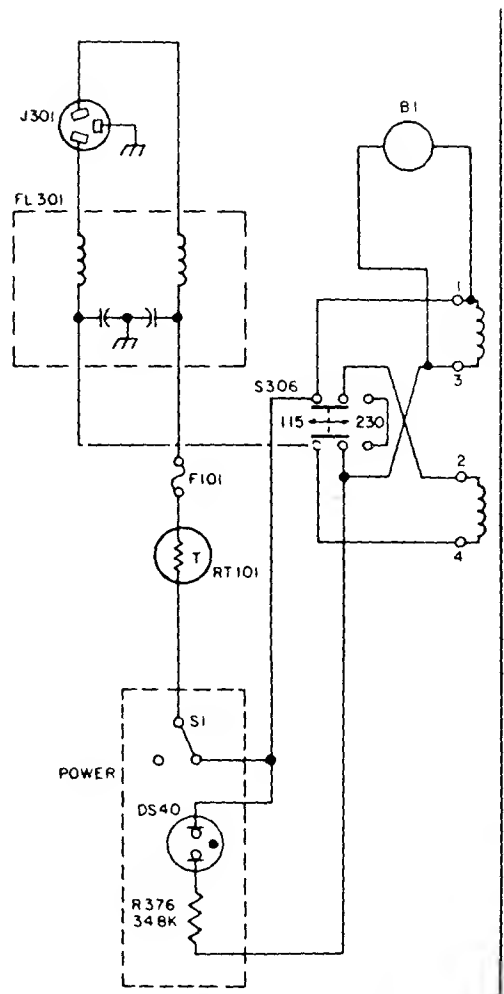


Figure II-7. Partial Schematic for Power Supply Section (P/O Change T)

Page 6-8, Table 6-2:

Change S1 to 3101-1248 SWITCH:PUSHBUTTON SPST ILLUMINATED.

Page I-6, Parts List for Figure I-3:

Change stock number for item 12 to 3101-1248.

Pages I-10 and I-11, Parts List for Figure I-5:

Change item 18 to 618B-36AT Ring, Pot Mounting.

Change part number for item 52 to 00618-0041.

Add the following items:

- 86. 08412-20022 Spacer HVRS Rec.
- 87. 0380-0046 Spacer, rnd, 0.375 in. lg.
- 104. 0360-0023 Strip, 7 terminal, 5 ins, 2 gnd.
- 105. 2190-0010 Washer, Ext lock for no.8 screw
- 108. 0380-0013 Spacer, 1/4 in. od, 1 in. lg.

Delete item 119.

Change item 107 to 2380-0007 Screw, Fillister head, 6-32 thd, 1-1/4 in. lg.

Change item 116 to 2360-0207 Screw: Machine 6-32 x 0.87.

CHANGE T (Cont'd)

Page I-12, Figure I-5:

Replace the entire figure with Figure II-8.

Page I-13, Figure I-6:

Replace the entire figure with Figure II-9.

Pages I-14 and I-15, Parts List for Figure I-6:

Change item 18 to 618B-36AT Ring, pot mounting.

Change the part number for item 52 to 00618-0041.

Add the following items:

86. 08412-20022 Spacer:HVRS Rec

87. 0380-0046, Spacer: Rnd. 0.375 in. lg.

88. 0360-0023 Strip, 7 terminal, 5 ins, 2 gnd

91. 2190-0010 Washer, Ext lock for no.8 screw

106. 0380-0013 Spacer, 1/4 in. od, 1 in. lg.

Change item 105 to 2380-0007 Screw, Fillister head, 6-32 thd, 1-1/4 in. lg.

Change item 118 to 2360-0207 Screw: Machine 6-32 x 0.87.

Delete items 120 and 122.

CHANGE U

Page I-18, Parts List for Figure I-8:

Change item 12 to 620A-36H.

CHANGE V

Page 5-37/5-38, Figure 5-31:

Change potentiometers R412 and R512 to 25K.

Change VR801 to 7.15V.

Change Q1 to 1850-0098.

Page 6-3 and 6-4, Table 6-2:

Change R412 and R512 to 2100-1472 R:VAR COMP 25K OHM 30% LIN 1/8W.

Page 6-5, Table 6-2:

Change VR801 to 1902-0074 DIODE ZNR 7.15V 5% DP-7 PD=0.4W.

Page 6-7, Table 6-2:

Change Q1 to 1850-0098 TRANSISTOR PNP GE CHIP TO-3 PD=90W.

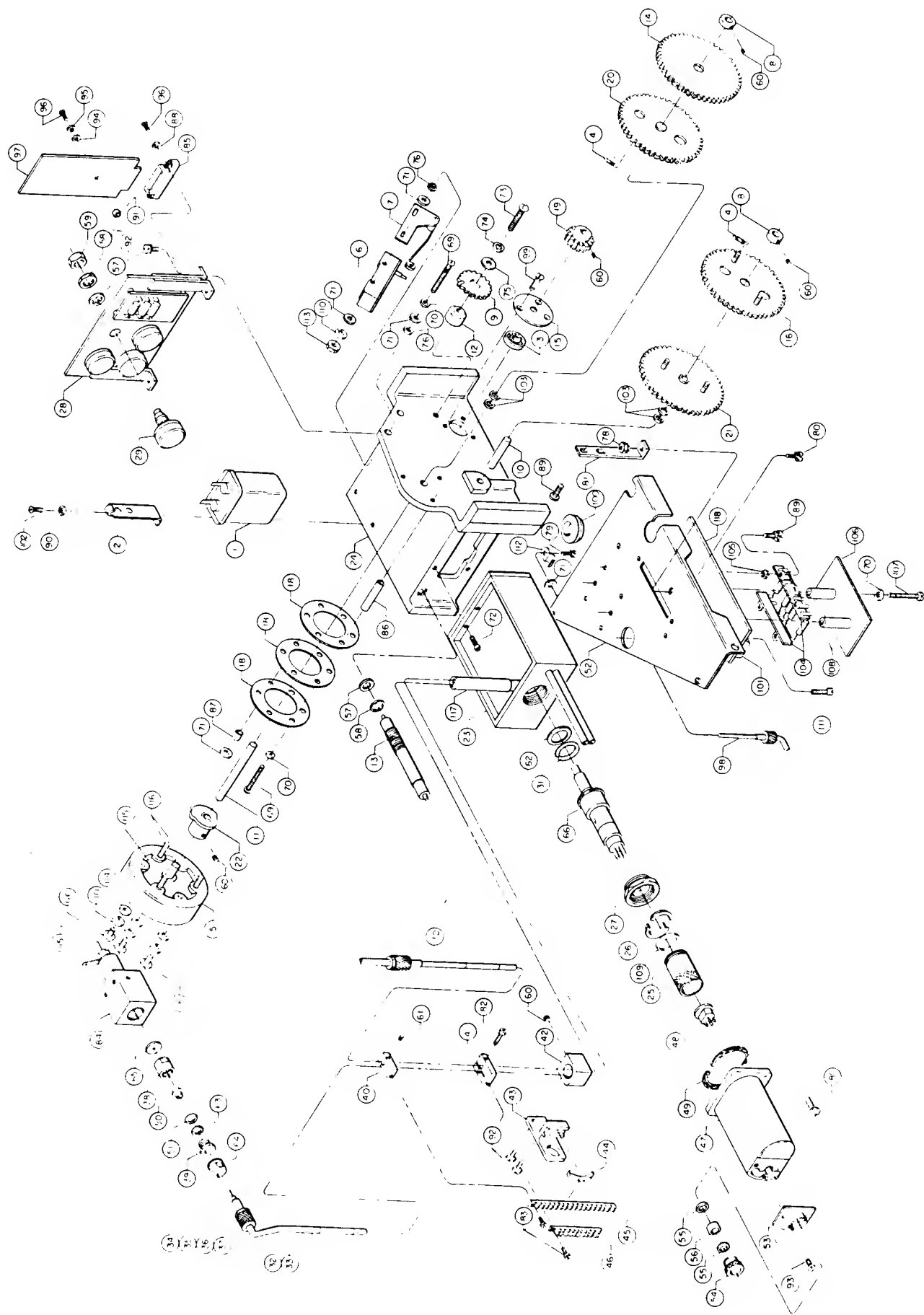


Figure II-8. HP Model 618C S.H.F. Signal Generator, Klystron Assembly and Drive Mechanism (P/O Change T)

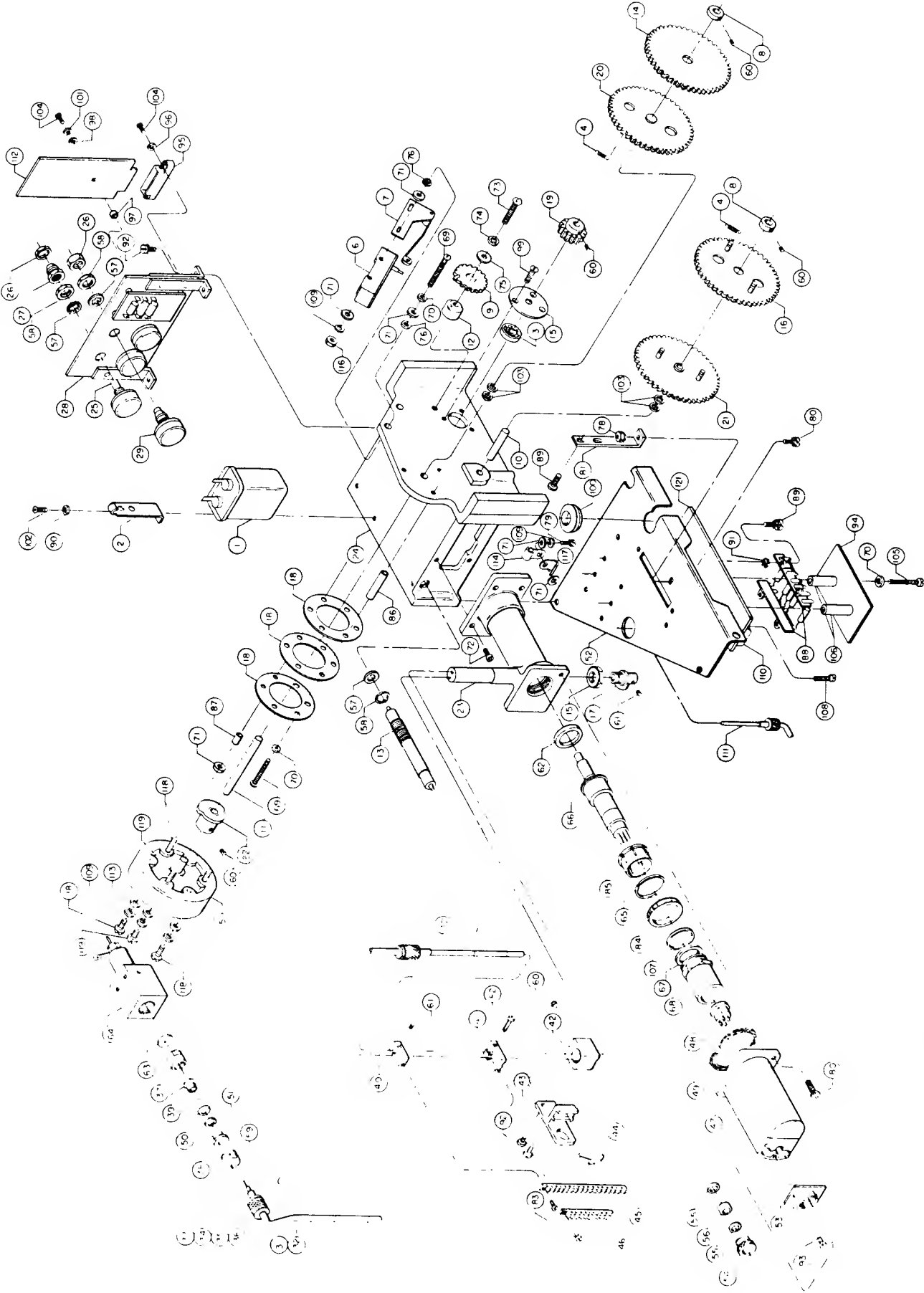


Figure II-9. HP Model 620B S.H.F. Signal Generator, Klystron Assembly and Drive Mechanism (P/O Change T)

SHF SIGNAL GENERATOR

MANUAL IDENTIFICATION

Model Number: 618C/620B
Date Printed: April 1980
Part Number: 00618-90029

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections

Make all appropriate serial number related changes indicated in the tables below.

| 618C | | 620B | |
|-------------------------|---------------------|-------------------------|---------------------|
| Serial Prefix or Number | Make Manual Changes | Serial Prefix or Number | Make Manual Changes |
| 1740A | 1 | 1745A | 1 |
| 1824A | 1, 2 | 1826A | 1, 2 |
| 1911A | 1-3 | 1914A | 1-3 |
| 2031A | 1-4 | 2040A | 1-4 |
| | | | |

► NEW ITEM

ERRATA

Page 3-7, Figure 3-5:

Add the following note:

SYNC. IN should not be used when the MOD. SELECTOR is in the + EXT. position. Spurious output may result.

Page 5-2, First table:

Change 5.653—5.7057 GHz to 5.643—5.757 GHz

Page 5-3, Figure 5-3:

Add a 20 dB attenuator at the input of the frequency counter.

Page 5-19, Paragraph h (column one):

- Change information inside the first set of parentheses to (approximately 8.9 GHz for the 620B and 4.2 GHz for the 618C).

Page 5-23:

Add the following paragraphs:

5-104. FACTORY SELECTED COMPONENTS

5-105. The following paragraphs explain how to choose the values of selected components. These components are designated by an asterisk (*) on the schematic and parts list.

5-106. SELECTING R157

5-107. Selected for minimum detected pulse width measured at the RF OUTPUTS when pulse modulating the Generator. If a minimum pulse width of 0.5 μ s cannot be obtained, change R157 to a lower value. The value should be between 1000 Ω and 2200 Ω .

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

ERRATA (Cont'd)

ge 5-23 (cont'd):

5-108. SELECTING CR701

5-109. The zener voltage of CR701 is selected so that the voltage on the plate of VR701 is more negative than -1020 Vdc with the MOD SELECTOR set to OFF. The range of CR701 is 100 to 120 volts (120 volts nominal).

NOTE

CR701 should be selected each time VR701 is replaced.

Page 5-31, Figure 5-28:

Add CR103 to the R169 connection for the 620B as follows:

CR103 Anode — junction of TB1(1) and R169.

CR103 Cathode — connection to the TB1 side of R177.

Change R603 to 147Ω.

Delete the R523 (ΔF) wiper connection to ground. Connect the wiper to the junction of R523 and R527.

Add R527 to Reference Designators table.

When the changing of R523 is necessary the recommended replacement is listed in **Change 4**.

(620B Only) Page 5-31/5-32, Figure 5-28:

Change the color code of the wire connected to the wiper of R168 from green (5) to brown (1).

Page 5-33/5-34, Figure 5-29 (Schematic and Component Identification):

Change voltage on V101 pin 6 to -240V. Change (on Component Identification, A1000) C142 to C143.

Change (on Component Identification, A900) C142 to C143 and C143 to C144.

Page 5-35, Figure 5-30 (Schematic and Component Identification):

Change R157 to R157*.

Add the following note at the bottom of the page:

*Selected value. See paragraph 5-106 for selection procedure.

Change (on Component Identification, A900) C142 to C143 and C143 to C144.

Page 5-37, Figure 5-31 (Component Identification):

Show (on Component Identification A800) the wire colors attached to the pins as listed in the following table:

Change (on Component Identification A900) C142 to C143 and C143 to C144).

| Pin Number | Wire Color | Pin Number | Wire Color |
|------------|------------|------------|------------------|
| 1 | — | 16 | violet |
| 2 | — | 17 | violet |
| 3 | yellow | 18 | violet |
| 4 | yellow | 19 | violet |
| 5 | pink | 20 | — |
| 6 | pink | 21 | white/green |
| 7 | white/red | 22 | white |
| 8 | red | 23 | white/violet |
| 9 | — | 24 | green |
| 10 | red | 25 | brown |
| 11 | red | 26 | white/yellow |
| 12 | orange | 27 | green |
| 13 | orange | 28 | white/black/grey |
| 14 | — | 29 | white |
| 15 | — | 30 | grey |

CHANGE 1

Page 4-7, paragraph 4-36:

Add the following information.

CR704 is selected for optimum tuning range of R706. CR706 is selected for optimum tuning range of R707.

R709 adjusts the leading edge of the modulation pulse.

Page 4-7:

Replace Figure 4-11 with the following figure.

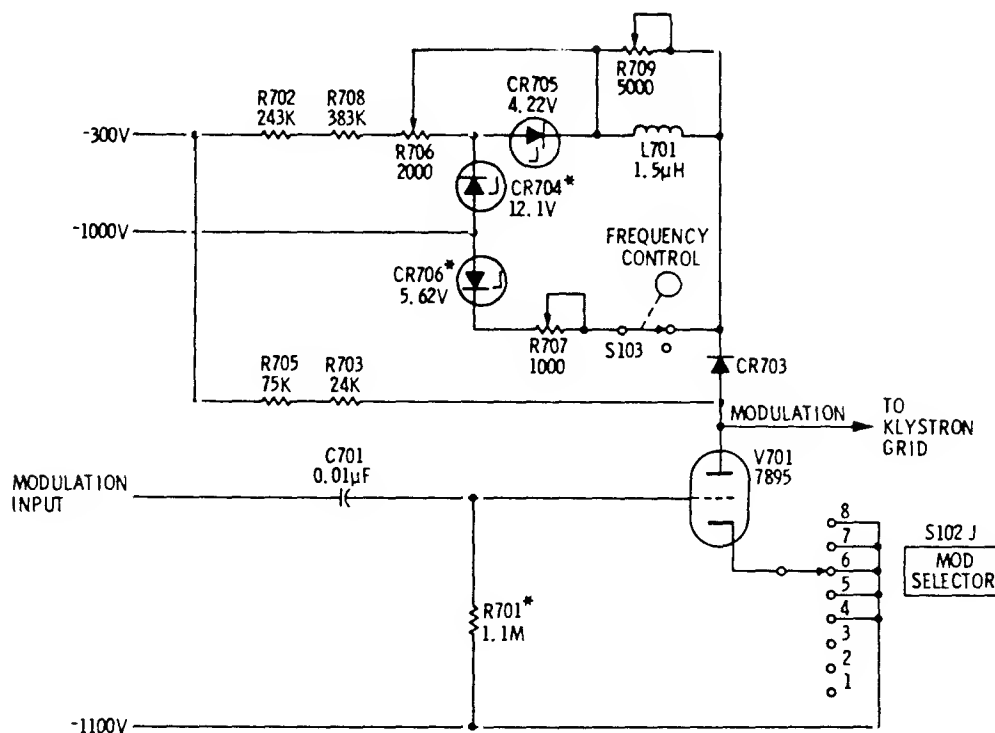


Figure 4-11. Schematic of Klystron Modulator (618C, Change 1)

Pages 4-7 and 4-8, paragraph 4-37:

Add the following information.

Zener diode CR704 is selected for optimum tuning range of R706. R709 adjusts the leading edge of the modulation pulse.

Replace Figure 4-12 with the following figure.

CHANGE 1 (Cont'd)

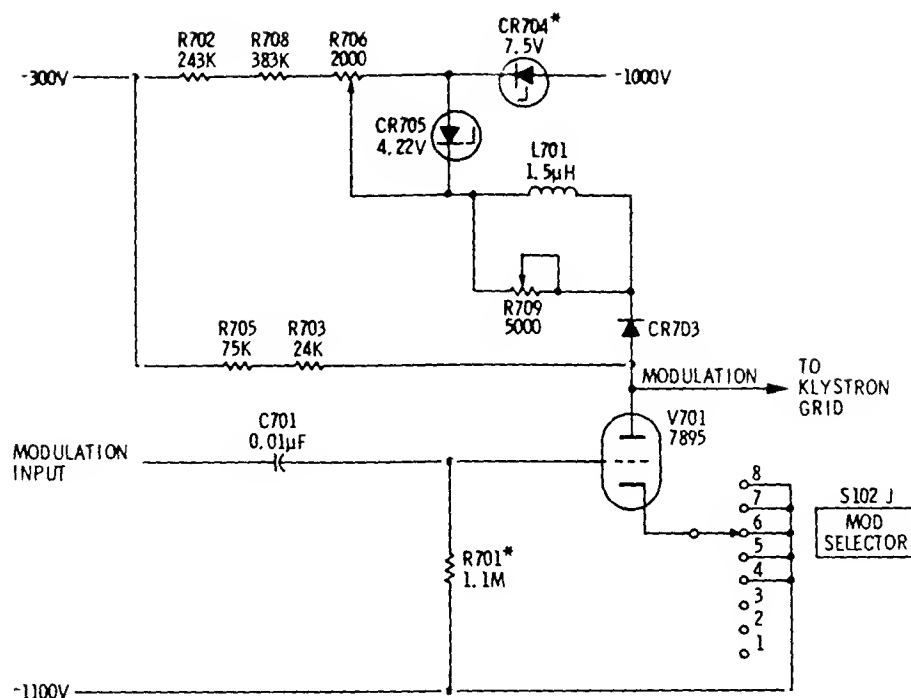


Figure 4-12. Schematic of Klystron Modulator (620B, Change 1)

Pages 5-6 and 5-7, paragraph 5-30:

In step c, change “approximately 15 mA” to “nominally 15 mA”

Add the following instructions after step c.

Select the value of CR706 as high as possible to obtain proper cathode current. A 4.22V zener diode is typical. Adjust R707 almost fully counterclockwise. This will generally result in the best pulse shape (refer to Figure 5-8a). Increasing zener voltage will raise the range of current adjustment. Refer to Table 5-2a for the HP part number for various zener voltages within the allowable range.

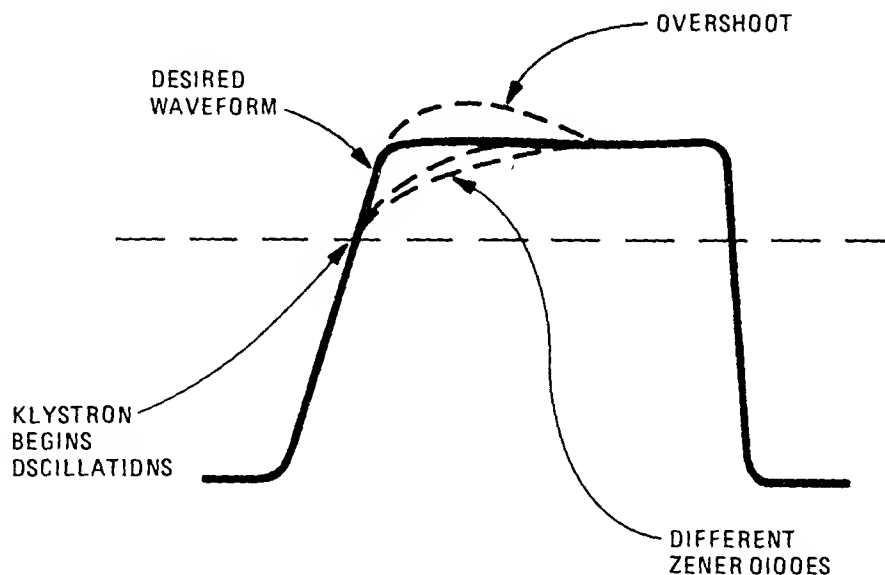


Figure 5-8a. Klystron Modulation Pulse Waveform (Change 1)

CHANGE 1 (Cont'd)

Pages 5-6 and 5-7, paragraph 5-30 (cont'd):

To select the value of CR704, tune the 618C above the frequency where the microswitch is actuated. Measure klystron beam current with R706 and R709 set fully counterclockwise. The minimum current should be about 25mA. If the minimum current is not correct, change the value of CR704 to obtain proper minimum current. A 7.5V zener is typical. Decreasing zener voltage will decrease klystron beam current. Use Table 5-2a to find the HP part number for various zener voltages within the allowable range. Adjust the beam current to get minimum pulse jitter consistent with best pulse shape. Beam current should be kept below 28mA. If necessary, rotate R709 clockwise to reduce jitter. Keep R709 as far counterclockwise as possible to maintain the best possible pulse shape.

Table 5-2a. CR704 and CR706 Selection Guide

| Zener Voltage | HP Part Number |
|---------------|----------------|
| 3.16V | 1902-3036 |
| 3.48V | 1902-3048 |
| 3.83V | 1902-3059 |
| 4.22V | 1902-3070 |
| 4.64V | 1902-3082 |
| 5.11V | 1902-0041 |
| 5.62V | 1902-3104 |
| 6.19V | 1902-0049 |
| 6.81V | 1902-0048 |
| 7.50V | 1902-0064 |
| 8.25V | 1902-3139 |
| 9.09V | 1902-3149 |
| 10.0V | 1902-0025 |
| 11.0V | 1902-3171 |
| 12.1V | 1902-3182 |
| 13.3V | 1902-3193 |
| 14.7V | 1902-3203 |
| 16.2V | 1902-0184 |

Pages 5-6 and 5-7, paragraph 5-30 (cont'd):

Change step f to read as follows:

Adjust R170 and R709 for best compromise between pulse shape and jitter. The best pulse shape generally occurs with R709 adjusted fully ccw.

Add the following instruction to step m.

If necessary, readjust R709 for optimum pulse shape and minimum acceptable jitter.

Pages 5-7 to 5-9, paragraph 5-32:

Add the following instructions to step d.

To select the value of CR704 the 620B can be tuned anywhere in the frequency band. Measure klystron beam current with R706 and R709 set fully counterclockwise. The minimum current should be about 25mA. If the minimum current is not correct, change the value of CR704 to obtain proper minimum current. A 7.5V zener is typical. Decreasing zener voltage will decrease klystron beam current. Use Table 5-2a to find the HP part number for various zener voltages within the allowable range. Adjust the beam current to get minimum pulse jitter consistent with best pulse shape. Beam current should be kept below 28mA. If necessary, rotate R709 clockwise to reduce jitter. Keep R709 as far counterclockwise as possible to maintain the best possible pulse shape.

CHANGE 1 (Cont'd)

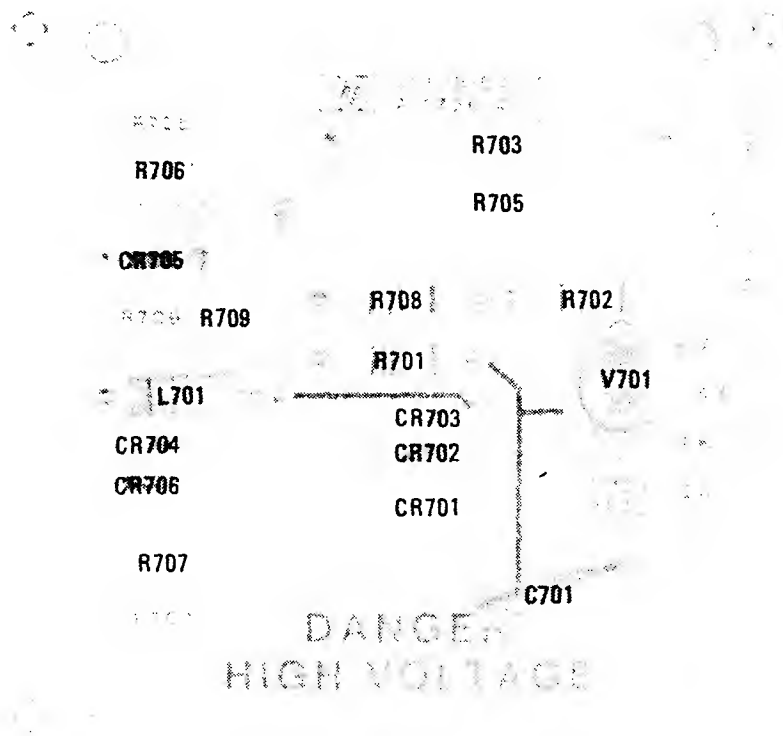
ge 5-7 to 5-9, paragraph 5-32 (continued):

Add the following instructions to step q.

Adjust R709 to obtain optimum pulse shape with minimum acceptable jitter. In some cases to minimize jitter, it might be necessary to allow slight overshoot of the leading edge (see Figure 5-8a). The best pulse shape generally occurs with R709 adjusted fully ccw.

Page 5-31, Figure 5-28:

Replace component identification photograph for A700 with the following photograph.



Component Identification, A700

Replace appropriate parts of schematic with the following partial schematic.

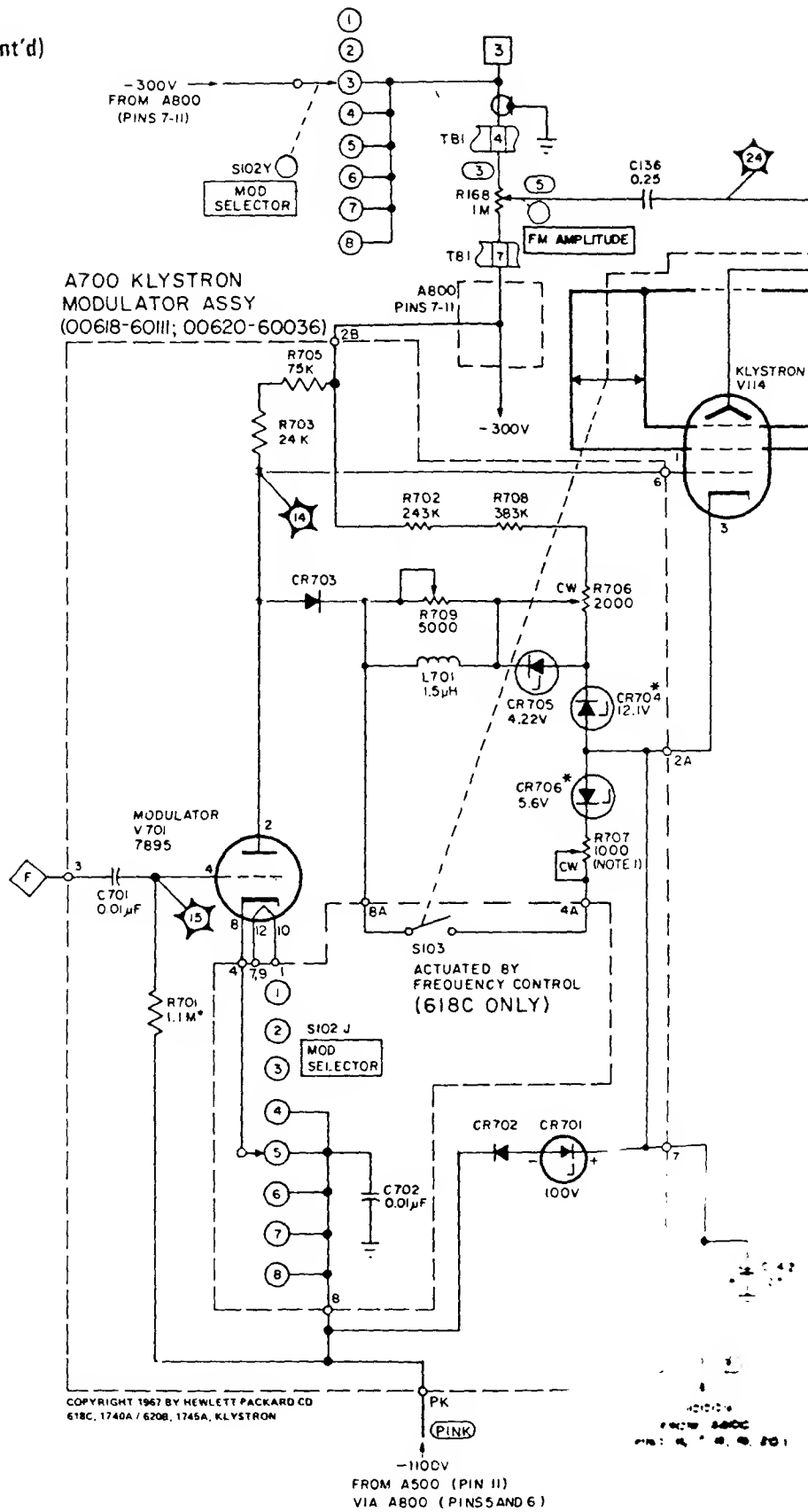
Also on schematic, change note 1 and the asterisk note (*) to read as follows.

1. R707, CR706, and S103 are included in 618C's only; omitted in 620B's.

* Factory selected part; typical value shown (typical value for CR704 on 620B's is 7.5V).

Continued

CHANGE 1 (Cont'd)



P/O Figure 5-28. Klystron Section

CHANGE 1 (Cont'd)

3C Only) Page 5-31/5-32, Figure 5-28:

Change the color code of the wire connected to the wiper of R168 from green **(5)** to brown **(1)** .

Page 6-4, Table 6-2:

Add CR704 1902-3182 CD0 DIODE ZENER 12.1V 5% DO-35 PD = 0.4W.

Add CR705 1902-3070 CD5 DIODE ZENER 4.22V 5% DO-35 PD = 0.4W.

Add CR706 1902-3104 CD6 DIODE ZENER 5.62V 5% DO-35 PD = 0.4W.

Add L701 9100-1657 CD8 INDUCTOR RF-CH-MLD 1.5 MH 5% .23D x .57 LG.

Change R706 to 2100-0567 CD0 RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TRN.

Change R707 to 2100-3211 CD7 RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN.

Add R709 2100-3252 CD6 RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN.

CHANGE 2

Page 6-7, Table 6-2:

Replace the fuseholder listing (below F101) with the following:

2110-0564 FUSEHOLDER BODY 12A MAX; 250V MAX 28480 2110-0564

2110-0565 FUSEHOLDER CAP BAYONET; 12A 250V MAX 28480 2110-0565

2110-0569 NUT-HEX, PLASTIC 28480 2110-0569

1400-0090 WASHER: RUBBER 5/8" OD 00000 OBD

CHANGE 3

Page 1-2, Table 1-1:

Replace the **Sync Out Signals**, and **External Pulse Modulation** specifications with the following:

Sync Out Signals: Simultaneous with RF pulse, positive. In advance of RF pulse, positive, variable 3 to 300 microseconds. (Better than 1 microsecond rise time and 20 to 100 volts amplitude into 1,000-ohm load.)

External Pulse Modulation: Pulse requirements: amplitude from 15 to 70 volts peak positive or negative, width 0.5 to 2,500 microseconds.

Page 5-3, Paragraph 5-19:

Replace steps c and h with the following:

c. Adjust Pulse Generator for a +15V peak, 1000-Hz output with a pulse width of 0.5 μ s.

h. Adjust Pulse Generator for +15V peak output. Display should be the same as in step g.

CHANGE 4

Page 5-31/5-32, Figure 5-28:

Change R523 to 500K.

Page 5-33/34, Figure 5-29:

Add C150 56 pF connected from V101-pin 7 to pin 8.

Page 6-7, Table 6-2:

Add C150, 0140-0191, Check Digit 8, CAPACITOR-FXD 56 PF \pm 5% 300VDC.

Page 6-8, Table 6-2:

Change R523 to 2100-2736 CD9 RESISTOR-VAR CONTROL C 500K 20% LIN.

K4XL's BAMA

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